Governor's Office, Bruce Nelson, Rm. 204, State Capitol, P.O. Box 200801, Helena, MT 59620-0801
Environmental Quality Council, Capitol Building, Room 106, P.O Box 201704, Helena, MT 59620
Montana Dept. of Environmental Quality, Metcalf Building, P.O. Box 200901, Helena, MT 59620-0901
Director's Office
Water Protection Bureau
Montana Dept. of Natural Resources and Conservation, 1625 11th Ave. Helena, MT 59620
Director's Office
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Water Resources Division, 1424 9th Ave., P.O. Box 201601, Helena, MT 59620-1601
Kerri Strasheim, Water Resources, Bozeman Regional Office, 2273 Boot Hill Ct. Suite 110, Bozeman, MT 59457
Montana Dept. of Fish, Wildlife & Parks, 1420 E. 6th Ave. Helena, MT 59620
Director's Office
Fisheries Division
Mike McLane
Bruce Rich, Regional Fisheries Manager, FWP Region 3 Office, 1400 S. 19th Bozeman, MT 59718
Dick Oswald, DFWP Fisheries Biologist, 730 ½ North Montana, Dillon, MT 59725
Jeff Ebert, Montana Dept. of Transportation Dist. 2–Butte, 3751 Wynne, PO Box 3068, Butte, MT 59702-3068
Andy Verhow, P.O. Box 465, Sheridan, MT 59749
Dufner Ranches, P.O. Box 278, Lima, MT 59739
Garden Creek Stock Association, P.O. Box 199, Twin Bridges, MT 59754
William F. Powers – Trustee, 630 Avenido Sevilla – Unit A, Laguna Woods, CA 92637
Ruby Dell Ranch, P.O. Box 85, Alder, MT 59710
Ruby Lake Ranch, P.O. Box 710, Sheridan, MT 59749
Ruby Valley Hydroelectric Authority c/o James R. Jackoway 1888 Century Park E. Los Angeles, CA 90067
Montana Environmental Information Center, P.O. Box 1184, Helena, MT 59624
Montana Audubon Council, P.O. Box 595, Helena, MT 59624
Madison County Commissioners, PO Box 278, Virginia City, MT 59755
Wildlife Federation, P.O. Box 1175, Helena, MT 59624
Trout Unlimited, P.O. Box 7186, Missoula, MT 59807
Dave Alberi, Vigilante Electric Cooperative, P.O. Box 1049, 225 E. Bannack, Dillon, MT 59725-0071
Dan Doornbos, President, Ruby River Water Users, PO Box 149, Alder, MT 59710
Tim Bozorth, Bureau of Land Management, Dillon Field Office, 1005 Selway Dr. Dillon, MT 59725-9431
U.S. Army Corps of Engineers, 10 W 15th St. Suite 2200, Helena, MT 59626
U.S. Fish and Wildlife Service, MT Field Office, 100 N. Park Ave. Helena, MT 59601

Ladies and Gentlemen:

The enclosed Environmental Assessment (EA) has been prepared for the Ruby River Dam Rehabilitation Project and is submitted for your consideration. Please contact me at (406) 444-6622 (e-mail jdomino@mt.gov) should you have any questions or comments. **Comments will be accepted until 5:00 p.m., Friday, December 19th 2008.** Comments can be mailed to:

James P. Domino
MT DNRC, State Water Projects Bureau
1424 9th Avenue, P.O. Box 201601
Helena, MT 59620-1601

Copies of the EA are available upon request. The EA can be viewed on the DNRC website at www.dnrc.mt.gov. Thank you.

Sincerely,

James P Domino

James P. Domino
Environmental Science Specialist

RUBY RIVER DAM REHABILITATION DRAFT ENVIRONMENTAL ASSESSMENT

Prepared By the State Water Projects Bureau, MT DNRC

November, 2008

CONTENTS **page**

LIST OF APPENDICIES, ACRONYMS AND ABBREVIATIONS……1
1.0 PURPOSE AND NEED FOR ACTION 2
1.1 Project Goals and Objectives 2
1.2 Project Location..... 3
1.3 Scope of Environmental Analysis 4
1.4 Applicable Regulatory Requirements 6

2.0 ALTERNATIVES INCLUDING THE PORPOSED ACTION……7
2.1 Development of Alternatives..... 7
2.2 Description of Alternatives..... 7

3.0 AFFECTED ENVIRONMENT..... 10
3.1 Geology 10
3.2 Topography 10
3.3 Water Resources..... 10
3.4 Soils 11
3.5 Vegetation 11
3.6 Wildlife..... 11
3.7 Fisheries..... 12
3.8 Ownership and Land Use 13
3.9 Cultural Resources..... 13
3.10 Noise 13
3.11 Air Quality..... 13
3.12 Transportation Facilities 13
3.13 Socio-Economic 14

4.0 ENVIRONMENTAL CONSEQUENCES..... 15
4.1 Geology 15
4.2 Topography 15
4.3 Water Resources..... 16
4.4 Soils 18
4.5 Vegetation 18
4.6 Wildlife..... 19
4.7 Fisheries..... 20
4.8 Ownership / Land Use 22
4.9 Cultural Resources..... 24
4.10 Noise 24
4.11 Air Quality..... 25
4.12 Transportation Features 25
4.13 Socio-Economic 25

5.0 CUMMULATIVE EFFECTS..... 28

6.0 PREFERRED ALTERNATIVE..... 28
6.1 Preferred Alternative B 28
6.2 Proposed Actions to Offset Adverse Impacts 35
6.3 Need for an EIS..... 36
6.4 Project Implementation..... 38
6.5 Monitoring……..38

7.0 GLOSSERY OF TERMS..... 39
8.0 REFERENCES..... 41
9.0 LIST OF PREPARERS……..42

LIST OF APPENDICIES

Appendix A Construction Diagrams
Appendix B Estimated Project Cost
Appendix C Photographs
Appendix D HKM Feasibility Study (not attached)**

**Appendix D, the HKM Feasibility Study Report is available for review at the State Water Projects Bureau Helena Office, (406) 444-6646

List of Acronyms and Abbreviations

BLM……..Bureau of Land Management

COE ..... U.S. Army Corps of Engineers

DEQ ..... Montana Department of Environmental Quality

DFWP ..... Montana Department of Fish, Wildlife, and Parks

DNRC ..... Montana Department of Natural Resources and Conservation

EA ..... Environmental Assessment

EIS ..... Environmental Impact Statement

MEPA..... Montana Environmental Policy Act

NHP ..... Montana Natural Heritage Program

USFWS..... U.S. Fish and Wildlife Service

USGS..... U.S. Geological Survey

SHPO..... Montana State Historic Preservation Officer

SWCB……..State Water Conservation Board

SWPB ..... State Water Projects Bureau

RRWUA ..... Ruby River Water Users Association

MBMG…….Montana Bureau of Mines and Geology

1.0 - PURPOSE AND NEED FOR ACTION

The Ruby Dam and Reservoir is located on the Ruby River, in Madison County approximately 7 miles south of Alder. The dam is owned by the DNRC & managed by the SWPB. The project has been operated by the Ruby River Water Users Association since the dam was built in 1938. The structure consists of an Earthen Embankment Dam, 111 feet high, 846 feet long with a reinforced concrete chute spillway, a 72-inch diameter slide gate (emergency gate) upstream from a 72-inch butterfly valve (operating gate), a reinforced concrete 90" outlet conduit and a 96-inch diameter concrete dry tower, from which both gates are operated. The dam was constructed in 1938 by the State Water Conservation Board. Storage at full pool (top of the existing flashboards) is 37,642 acre-feet. Two privately owned canals deliver water to purchasers: The West Bench Canal, which is 12 miles long with an 85 cfs capacity; and the Vigilante Canal, which is 26 miles long with a 115 cfs capacity. 149 water users have 219 contracts for 38,845 acre/feet of water.

The spillway condition has been deteriorating for many years. An inspection conducted by the Army Corps of Engineers (COE) in 1981 found the spillway capacity inadequate, with the spillway showing serious deterioration. For this reason, the Corps classified the dam as unsafe according to the standards set forth under the National Dam Inspection Act, Public Law 92-367. The spillway has since deteriorated to the point that replacement of the entire structure is needed.

The proposed action calls for the construction of a new spillway that will meet or exceed all current state dam safety requirements. The existing low level outlet control gate will be removed and the downstream portion of the outlet works conduit will be slip lined with a steel penstock. A new control gate will also be installed on the downstream end of the penstock at the dam toe. A new outlet terminal structure will also be constructed to replace the existing deteriorating structure.

Sedimentation has reduced the storage capacity of the reservoir by approximately 2,000 acre-feet over the past 70 years. In order to enhance and reestablish the original storage capacity of the reservoir, the proposed action calls for the spillway crest to be raised 7.0 feet above the existing flashboards, and the dam crest raised 4 feet. This will increase the existing capacity of the reservoir from 37,642 (existing top of flashboards) to 45,115 acre-feet. This will provide an additional 7,473 acre-feet of storage (recovers the 39,850 a/f original water right plus 5,265 acre-feet), of which 2,600 acre feet is proposed to become an established minimum pool for the reservoir, downstream fisheries and their beneficial uses.

Approximately 30,000 cubic yards of material will be used in the cut and fill operation for the installation of the new spillway, outlet terminal structure and the dam crest increase, with approximately 20 disturbed surface acres.

The overriding goal of this project is to improve the efficiency, safety and functionality of the Dam for it's continued use for agricultural irrigation and recreation. Public benefits from this project include providing reservoir water for agricultural irrigation, recreation, fisheries and wildlife habitat. Greatly enhanced public safety is an additional and very significant benefit.

1.1 Project Goals and Objectives

Goals of the dam rehabilitation project include the following:

A. Reduce the likelihood of dam failure and the resulting potential loss of life.

B. Meet Montana Dam Safety's spillway standards.

C. Meet established outlet capacity for reservoir evacuation criteria.

D. Control seepage to avoid potential stability problems.

E. Avoid spillway failure in the event of the design flood.

F. Extend the dam's useful life and its advantages another 50 to 75 years with minimal negative environmental or socio-economic impacts.

Project Objectives include:

1. Optimize design work for most cost effective rehabilitation option without compromising safety or causing significant environmental damage.

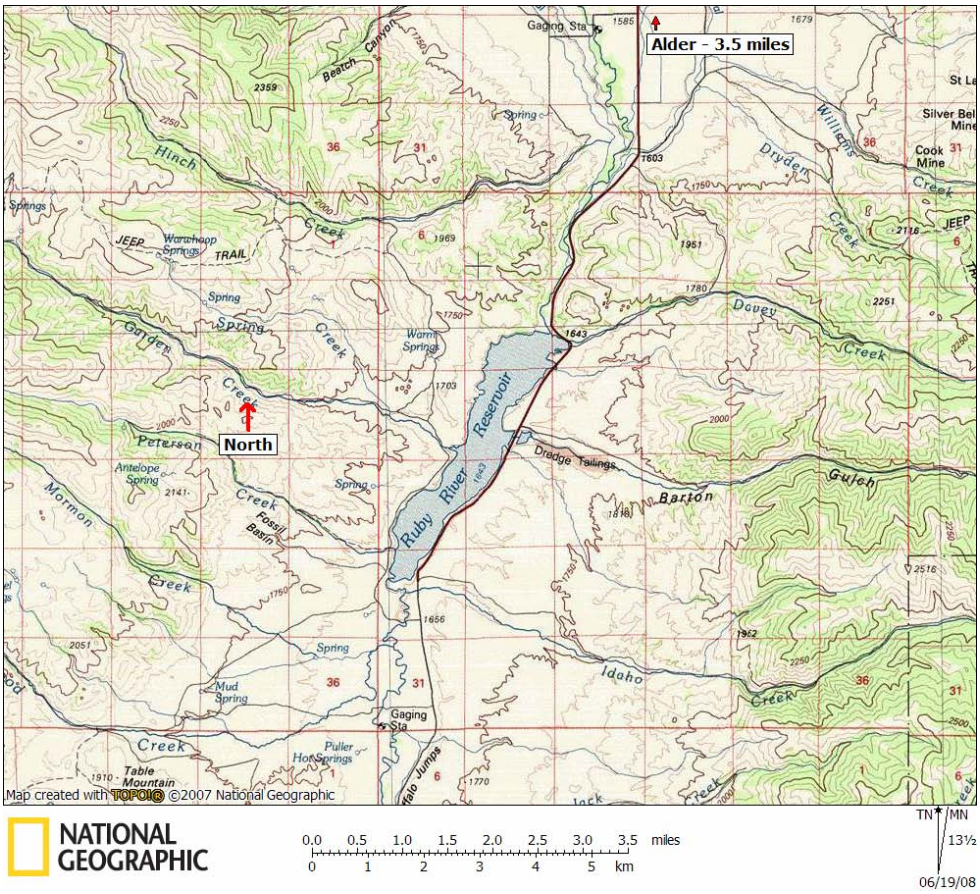
2. Replacement of the deteriorated spillway with a new spillway designed to meet Montana spillway standards and preserve dam integrity.

3. Replacement of the deteriorated outlet structure and installation of a seepage collection system to control seepage.

4. Increase the storage capacity of the reservoir by 7,473 acre-feet by raising the spillway crest 7.0 feet above the existing flashboards and raising the dam crest 4 feet to recover the original water right, and potentially provide opportunities for additional beneficial water uses.

1.2 Project Location

The Ruby River Dam and Reservoir are located in Madison County, Montana, at Township 7 North, Range 4 West, Northeast 1/4 of the Southeast 1/4 of Section .8, approximately 10 miles south of Alder.



1.3 Scope of Environmental Analysis

Public and Agency Involvement

Other state and federal agencies have been contacted by the DNRC to discuss the project and to identify potential environmental issues. Representatives from the COE, DFWP, DEQ, NHP, and the SHPO were contacted. Representative from the RRWUA were also involved in the planning process.

Issues Studied in Detail

The issues examined in detail in this draft EA were identified by the DNRC, communications with the RRWUA, other agencies, and through comments received during the development of the feasibility study and the DNRC grant proposal process. Issues identified through the public comment period (see cover letter) will be addressed in the final EA. Listed below are potential project-related impacts examined in detail:

- Effects on downstream water quality and quantity.
- Effects on Plant and Animal Threatened and Endangered Species, and Species of Special Concern, and effects to other wildlife and fisheries resources.
- Effects to agricultural water uses, public and private land use and ownership.
- Effects to public safety, including traffic, noise, air quality, etc.
- Effects on stream bank and soil erosion due to project construction.
- Effects on recreation and esthetics.

- Effects on private property, the local economy and government services.
- Effects on historic and cultural resources.
- Effects on vegetation, including weed proliferation.
- Cumulative and secondary effects due to project construction.

Issues Eliminated from Further Study

The issues beyond the scope of this EA and eliminated from further study are as follows:

- Installation of a Hydroelectric Generating Station:

This issue is beyond the scope of this EA. Any future proposal to install a hydropower facility will be addressed in a separate EA. The outlet conduit lining proposed for installation in the preferred alternative could be retrofitted for hydropower in the future if desired.

- Sale of and / or use of additional stored water:

This issue is beyond the scope of this EA. The potential for the sale of additional stored water for beneficial uses will be addressed through the water rights permitting process.

These above issues are not related to the project goals and objectives of rehabilitating the dam to meet current state safety standards and replacing storage lost to sedimentation. If pursued, they will be addressed separately from the rehabilitation and involve individual EA's for each issue.

DNRC Decision Criteria

Along with the MEPA requirements, when deciding on actions and management initiatives to address water storage issues, the DNRC, by statute, must consider the following, as stated in Section 85-1-701(2) to (3):

(2) In setting priorities among new water storage projects, the governor shall consider whether a project:
(a) solves a severe water problem
(b) provides multiple uses and benefits
(c) provides for public uses
(d) shows strong evidence of broad citizen support
(e) is able to obtain non-state sources of funding
(f) protects and seeks to enhance social, ecological, cultural and aesthetic values
(g) improves local and state economic development
(h) could resolve Indian and federal reserved water rights issues
(i) supports water conservation activities; and
(j) promotes the use of water reserved under Montana law.

(3) In setting priorities among water project rehabilitation, the governor shall consider if the project:
(a) is needed to protect public safety
(b) has impacts if not repaired or rehabilitated; and
(c) accomplished the goals listed in (2)(a) through (2)(j).

The Ruby Dam Rehabilitation Project fulfills criteria 3(a),(b) and (c).

1.4 Applicable Regulatory Requirements

Montana Department of Natural Resources and Conservation (DNRC)

- Montana Dam Safety Act: 85-15-105 MCA – This act applies to the construction, repair, or removal of any dam that impounds 50 acre-feet or more at normal pool elevation. A Dam Safety Permit from the Dam Safety Section of the DNRC would be required for the proposed action.

Montana Department of Fish, Wildlife and Parks (DFWP)

- Non-Game and Endangered Species Conservation Act: 87-5-101 MCA - "Species or subspecies of wildlife indigenous to this state which may be found to be endangered within the state should be protected in order to maintain and to the extent possible enhance their numbers."

- Montana Stream Protection Act: 87-5-501 MCA (SPA 124-Permit) – Applies to any project including the construction of new facilities or modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream, its banks or tributaries.

Montana Department of Environmental Quality (DEQ)

- 318 Authorization: 75-5-308 MCA - The proposed construction would likely increase suspended sediment and turbidity to levels above established standards under all of the action alternatives. Therefore, a short-term exemption from surface water quality standards (318 authorization) from the Montana DEQ would be needed before project construction could commence.

- MPDES Permit: 75-5-401 MCA - If construction would require dewatering pumping, a Montana Pollutant Discharge Elimination System Permit (MPDES) would be required from DEQ.

- Storm Water Discharge: 75-5-401 MCA - A Storm Water Discharge Permit, issued by DEQ, may be required during construction under all of the action alternatives.

Montana State Historic Preservation Office (SHPO)

- Montana Antiquities Act: 22-3-421 through 442 MCA – Consultation with the SHPO on possible effects to cultural or historic resources as a result of the construction.

Montana Department of Transportation (MDOT)

- Encroachment Permit: MCA 76-3-403 - Approval from the MDOT for occupancy or special use of a state highway right-of-way.

U.S. Army Corps of Engineers (COE)

- Federal Clean Water Act: 33 C.F.R. 209 and 40 (404-Permit) – This permit is required when a project will result in the discharge or placement of dredged or fill material in waters of the United States. “Waters of the United States” includes lakes, rivers, streams, wetlands and other aquatic sites. It is anticipated that some fill material may be placed below the high water level of the reservoir during construction under the action alternatives.

U.S. Fish and Wildlife Service (USFWS)

- Endangered Species Act: 16 U.S.C 1531-1544 - Compliance and Consultation

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the alternatives that were analyzed in this EA.

2.1 Development of Alternatives

There are many possible variations or alternatives to any proposed action. However, the purpose of developing project alternatives is to address issues or potential problems raised by the proposed project. In addition to the No Action and the Proposed Action, other alternatives have been developed and are described in section 2.2. In October, 2005 the DNRC contracted with HKM Associates to conduct a Rehabilitation Feasibility Study for upgrading the dam to current state dam safety standards. The study was summarized in a January 2007 report to DNRC. The study included the following elements:

- Land Resource and Ownership
- Flood Hydrology and Water Availability
- Geotechnical Investigation and Analysis
- Rehabilitation Plan with Alternatives and Cost Estimates
- Project Evaluation with Farm Budget Analysis and Economic Analysis

Primary Issues

The primary issue that has emerged through the feasibility study and agency contacts is how the proposed project will alleviate public health and safety concerns related to the dam's unsafe condition, while continuing to provide agricultural, recreational, economic, and fish and wildlife resource benefits with the least amount of negative environmental impact. Primary to this issue is how the project may affect water quality, water flows, fisheries, wildlife habitat, private property and recreational use at the reservoir and downstream from the dam. Some downstream irrigators are concerned that addressing water quality concerns will in some way affect their ability to divert and utilize the water they require for irrigation and stock watering. The DFWP is concerned about flows, fisheries and impacts to wildlife and recreational use. The DEQ expressed concerns on water quality. It is these concerns that have resulted in the inclusion of the "Proposed Actions to Offset Adverse Impacts" section as part of the action alternatives presented in Section 6.0.

Other Relevant Issues

As identified in Chapter 1.0, other relevant issues are raised by the proposed project. These include, among others, potential effects to land use, wetlands, soils, cultural resources, and social and economic considerations. The effect of the preferred alternative on these individual resource areas is examined and compared in the succeeding chapters.

2.2 Description of Alternatives

Various alternative spillway configurations were presented in HKM's 2007 Feasibility Report. The alternatives were developed to identify the most cost effective design that will pass the 24,000 cfs in-flow design flood and provide increased water storage, with limited environmental impacts. A summary of the alternative spillway and embankment configurations is provided in Section 6.

Implementation of the alternatives (other than the No Action alternative) would follow the same procedures and schedule, as detailed in the proposed project schedule (page 33). The action alternatives would have similar environmental impacts, since the proposed construction activities and schedules are essentially the same for each alternative. Any differences in the impacts with the action alternatives primarily involve differences in the flooded acreage of the reservoir's full and flood pool storage. Alternative B, the preferred alternative, increases the storage capacity of the reservoir by raising the dam crest to an elevation of 5,400 feet for a total storage of

45,115 acre-feet. Alternative C involves raising the dam crest to elevation 5,396.7, for a total storage of 41,450 acre-feet. Alternative D involves replacing the spillway, outlet terminal structure and installing new drains without any increase in current storage (37,642 acre-feet). The potential impacts of the preferred alternative will be identified for each issue studied in detail, as presented in Section 4.

Alternative A - No Action

The *No Action Alternative* serves as a baseline description for current conditions at the project site. The current conditions at the project site would continue under this alternative.

The no action alternative would result in continued deterioration of the dam and associated structures, possibly resulting in partial or total failure in the event of a flood episode, increasing the threat to property and people living downstream. Downstream water quality would be negatively impacted due to the erosion and turbidity resulting from partial or total failure, with negative impacts to reservoir and downstream aquatic habitats. Water available for agricultural and recreational use would also be negatively impacted if no action is taken.

Alternative B – Preferred Alternative

The preferred rehabilitation plan includes raising the reservoir's full pool to elevation 5,400, replacing the spillway with a new structure, slip lining the existing outlet conduit, replacing the existing outlet control valve with a new valve at the downstream toe, and constructing new maintenance access to the downstream toe and over the spillway crest. Elevation 5,400 was selected as the practical maximum storage level due to potential impacts around the reservoir shoreline. The existing concrete crest is at elevation 5,392 with wooden flashboards to elevation 5,393. The storage at elevation 5,400 will be 45,115 acre-feet. Updated mapping of the reservoir indicates that 2,200 acre-feet of storage has been lost to sedimentation since the original construction. A minimum pool of 2,600 acre-feet is also desired to avoid low storage levels that may cause adverse fisheries impacts. Under alternative B, an additional 2,665 acre-feet of storage would be available for potential marketing to new uses. Evaluation of historic flows at the dam indicates that 7,000 acre-feet of additional water could be stored 8 out of 10 years. Marginal project costs associated with raising the pool to elevation 5,400 are well below the economic benefits of the additional storage.

Alternative C - Alternative C included all the components of the preferred alternative with the exception of raising the spillway crest to elevation 5,400. Under this alternative the spillway crest would be raised to elevation 5,396.7, allowing for a total storage of 41,450 acre-feet. This alternative would make up for the 2,200 acre-feet of storage lost to sedimentation, provide the existing water marketing contracts, and allow for the proposed minimum inactive pool of 2,600 acre-feet.

Alternative D – Alternative D includes all the components of the preferred alternative with the exception of raising the reservoir's maximum storage capacity. Under this alternative the storage would remain the same (spillway crest elevation 5,393, total storage of 37,642).

Table 1 provides a summary comparison of the alternatives.

Table 1 – Storage Option Summary

	Spillway Crest Elevation	Reservoir Storage	Comments
Alternative A (No Action)	5393.0	37,642 acre-feet	Increasing risk to public health and safety due to progressive deterioration. Ability to deliver irrigation water, recreation and fisheries would be negatively impacted.
Alternative B (Preferred)	5,400	41,450 acre-feet	Provides 2,665 ac-ft new active pool as well as 2,600 ac-ft min. pool and existing water right. Would require new water rights for new min and active pools. Both would be junior to existing rights.
Alternative C	5,396.7	41,450 acre-feet	Provides 2,600 ac-ft min. pool and satisfies current water marketing contracts. Would require new water right for initial filling and maintenance of min. pool. New water right would be junior to existing rights.
Alternative D	5,393	37,642 acre-feet	Existing flashboards. Approx. 3,800 ac-ft less storage than current contracts of 38,845 ac-ft, if min. pool of 2,600 ac-ft is maintained.

*Original Water Right – 39,850 ac-ft. with 38,845 shares marketed.

Please note: Hydropower and water right issues are not addressed as part of this EA. They will be addressed in separate, future EAs if warranted.

3.0 - AFFECTED ENVIRONMENT

To evaluate potential impacts resulting from the proposed alternative and the other alternatives described in Chapter 2.0, it is necessary to understand the current environmental condition of the project area.

3.1 Geology

The dam and reservoir lies in a narrow valley between the Ruby Range to the west and the Gravelly Range to the east, through which the Ruby River Flows. Precambrian metamorphic bedrock underlies the site. Local geologic units consist of a complex metamorphic assemblage, chiefly dolomitic marble, chert, quartzite, conglomerate and granitic gneiss. Various tertiary deposits are exposed in the slopes around the dam and reservoir. These materials are alluvial fan deposits, lakebed sediments, windblown silts and volcanic debris.

3.2 Topography

The area consists of basin and range topography, completed by thrust faulting, with gentle to steeply sloping terrain. Landforms in the area are dominated by benchlands, rolling hills and buttes, with moderate to steep grades, bisected by entrenched stream courses and drainages. Slopes in the vicinity of the dam and along the reservoir shore are gently inclined. Elevation in the project area along the Ruby River at the base of the dam is approximately 5,300 feet.

3.3 Water Resources

The Ruby River watershed encompasses approximately 623,000 acres in Madison County in southwest Montana. The Ruby Watershed drains portions of 5 mountain ranges. The southern portion of the Ruby River drainage originates in the Gravelly, Snowcrest, Greenhorn, and the southern portion of the Ruby Range. The Tobacco Root Mountains and the Ruby Range flank the east and west sides of the lower watershed. The Ruby Reservoir was constructed on the mainstem of the Ruby River in a canyon located approximately in the center of the watershed.

The Ruby River Basin makes up the center of the Gravelly landscape and flows northward between the Gravelly and Snowcrest Mountain Ranges. Most of the reaches in this basin exhibit high levels of instability and sediment due to mass wasting and active tectonism. The instability of the mainstem Ruby River above Vigilante can be mainly attributed to these forces.

(See Fisheries Section 3.7 for additional information on reservoir and dam operations as they relate to minimum reservoir pool and downstream flows).

WATERSHED AND STREAM CONDITIONS IN THE GRAVELLY LANDSCAPE

The Ruby River, measured above the reservoir, drains about 595 square miles of the Ruby River Watershed and extends beyond the Gravelly Landscape boundary. The highest recorded runoff season occurred in 1984 when 188,470 acre feet passed the USGS stream gauge located upstream from the reservoir. The lowest recorded runoff season occurred in 1961 when 47,860 acre feet passed the gauge. Average flow is about 90,000 acre feet. The Ruby supplies water to Ruby River Reservoir (~38,000 acre feet) which in turn supplies water to irrigate about 29,000 acres plus supplemental irrigation to an additional 12,000 acres.

The Ruby supports a good population of Brown Trout in its lower reaches and Rainbow and Cutthroat trout in its upper reaches. The Ruby River is listed as a chronically dewatered stream by the DFWP from Clear Creek to Alder.

The whole length of the Ruby River, from it's headwaters to the confluence of the Beaverhead River is identified as impaired on Montana's 303(d) list. In addition, 23 tributaries were listed in 1996, 18 of which are still considered impaired. The Ruby Reservoir was also listed in 1996, but is no longer considered impaired after more recent data was considered. The Ruby River carries a large, naturally occurring sediment load due to the highly erosive and generally unstable nature of soils found within the drainage.

The Ruby River Watershed Total Maximum Daily Loads and Framework for a Water Quality Restoration Plan, published in December 2006 by the Montana DEQ served as a reference for section 3.3. The report provides detailed information and analysis on the current state of water quality within the watershed. It is available for viewing on-line at the DEQ website at:

http://www.deq.mt.gov/wqinfo/TMDL/Ruby/Master.pdf.

Wetlands: No known wetlands exist within the immediate area of the dam. Wetlands are present in the upper reaches of the reservoir. These wetlands are altered (dependent on the dam) and consist primarily of scrub-shrub and forested classes. They are seasonally flooded and dewatered depending on reservoir storage and releases from the dam. Acreages vary depending on reservoir storage, with an estimated 160 wetland acres at the current full pool (elevation 5,393, 37,611 acre-feet), to 100 acres at the current minimum winter storage of 2,600 acre-feet (elevation 5,330.27).

Water Rights and Reservations: The DNRC, State Water Projects Bureau has a storage right dated April, 1938, with a reservoir capacity of 39,850 acre-feet.

3.4 Soils

Various tertiary deposits are exposed in the slopes around the dam and reservoir. These materials are alluvial fan deposits, lakebed sediments, windblown silts and volcanic debris. Mostly loam type soils are present, with major series including Musselshell gravelly loam, Crago very gravelly loam, Crago very stony loam and Rivra gravelly sandy loam. Soils are mostly deep and well drained.

3.5 Vegetation

The plant communities present in the project area include pasture grassland, irrigated cropland, and floodplain vegetation, including sage, willow, cottonwood, water birch, dogwood, alder, rose, snowberry and buffalo berry. The shoreline of the reservoir and adjacent land supports good native grass, especially to the west.

Species of Special Concern: Erigeron parryi (Parry's fleabane), a state species of special concern has been identified in the vicinity of the dam and in upland areas adjacent to the east shore of the reservoir. The preferred habitat of the plant is skeletal, limestone-derived soils of ridge crests, slopes and outcrops at 5,200-6,200 feet.

Weeds: Spotted knapweed is broadly distributed around the shore of the reservoir, with the highest densities along the east shore. Canada thistle, musk thistle, houndstongue, and common mullein occur in varying densities around the entire shore. The camping areas and recreational access roads on the east shore are the most significant problem areas for weed infestations.

3.6 Wildlife

Wildlife commonly found in the vicinity of the project area include moose, elk, mule deer, white-tailed deer, pronghorn, beaver, muskrat, mink, Colombian ground squirrel, mountain lion, black bear, coyote, fox, raccoon, badger, sage grouse, sharp-tailed grouse, ruffed grouse, ring-necked pheasant, Canada geese, great blue heron, sand hill crane and a variety of duck and song bird species. Raptors that have been sighted in the area

include bald eagles, golden eagles, great horned owls, turkey vultures, osprey and red-tailed hawks. Osprey, golden and bald eagles and great-horned owls are not year-round residents of the area.

Species of Special Concern: An active bald eagle nest is located on private land approximately 2 miles southwest of the dam. The lynx is also listed as threatened in the western third of Montana (including the project area). No other threatened, endangered or species of special concern have been observed.

3.7 Fisheries

Brown trout are the predominant game fish in the river below Ruby Reservoir. Rainbow trout are also found in lesser numbers. Other fish species present include mountain whitefish, mottled sculpin, longnose sucker, white sucker, and longnose dace.

The Consent Decree between the DNRC, RRWUA and DEQ entered into after the 1994 sediment release and subsequent fish kill called for minimum flows of between 20 to 30 cfs (from November through March) to protect downstream fisheries. A minimum pool of 2,600 acre-feet was also established. The Consent Decree was terminated by the Montana First Judicial Court in November 2002 after the respective parties and the Court agreed that all obligations under the Decree were fully met. The reservoir and dam are still voluntarily managed under the Decree stipulations.

Species of Special Concern: westslope cutthroat trout, a state species of special concern, are found in the upper reaches of the watershed above the reservoir. No other threatened, endangered or species of special concern have been observed within the project area.

Excerpt from the DFWP Montana Fishing Guide

Ruby River (blue ribbon stream)

Tributary of Beaverhead River.
(River Mile: 0 to 97)

The Ruby River originates at the convergence of its East, West, and Middle Forks and runs in a northwesterly direction for 97 miles. In its upper section, the river flows through the Beaverhead - Deerlodge National Forest between the Gravelly and Snowcrest mountain ranges. Fourteen miles downstream it veers gradually west to run alongside the Ruby Range and into the Ruby River Reservoir, which was built in 1939 to store irrigation water. The upper basin's grasslands, historically a summer range for American bison, bighorn sheep, pronghorns, and grizzly, are prone to erosion and mass wasting, leading to turbid water flows in the river. Below Ruby Reservoir the stream meanders past Alder and just west of Nevada and Virginia cities, three of Montana's historic gold mining towns. The Ruby completes its last 45 miles below the Ruby River Dam in a wide, open agricultural valley and joins the Beaverhead River near Twin Bridges, Montana. Gravel roads which parallel the upper river allow excellent access. Hunting, camping, timber harvesting, and mining join fishing, and cattle and sheep grazing as traditional uses supported by the Ruby River.

Total Length: 97 miles **FWP Region:** Region 3
Fishing District: Central Fishing District
Species Present

Game Fish Opportunities:
Brown Trout, Mountain Whitefish, Rainbow Trout

All Species Present:
Brook Trout, Brown Trout, Burbot, Common Carp, Longnose Dace, Longnose Sucker, Mottled Sculpin, Mountain Whitefish, Rainbow Trout, Rainbow X Cutthroat Trout, Westslope Cutthroat Trout, White Sucker, Arctic Grayling

Fisheries section reference – MT DFWP On-line Fishing Guide, DFWP Website: www.dfwp.mt.gov

3.8 Ownership and Land Use

Land Ownership: Land ownership within the project area and immediate vicinity of the reservoir includes federal, state and private lands.

Land Use: Primary land uses in the vicinity of the project area include livestock grazing, farming (primarily hay and alfalfa), and recreational use associated with the Ruby River, Ruby River Reservoir and surrounding lands. BLM land is found along the east and north sides of the reservoir, with a primitive BLM campground and boat ramp located along the reservoir's east shore. Mining and cattle grazing occur on both public and private lands in the area. Most of the land surrounding the reservoir on the west and south shores is privately owned. State Highway 357 runs along the east side of the reservoir.

Several homes exist in the vicinity of the reservoir, primarily on the east and south side and north of the dam along State Highway 357.

Regulatory Restrictions on Private Property Rights: The Ruby River Reservoir and Dam are owned by the State of Montana. Private land exists on the west and south shore of the reservoir. No regulatory restrictions on private property are associated with the normal operation and maintenance of the dam and reservoir.

Wilderness: No designated wilderness or wilderness study areas exist in the immediate area.

3.9 Cultural Resources

The Ruby River Dam has been documented and recorded as a cultural resource (site number 24MA350) due to the dam's age. The dam was completed in 1938. A cultural resources inventory was completed in January, 2006 by Ethos Consultants Inc of Billings, Montana. An on-site survey of the reservoir shoreline was also completed by the DNRC Archeologist in 2007. No cultural sites or artifacts were found during the 2006 and 2007 surveys.

Cultural Uniqueness and Diversity: No unique cultures or cultural diversities exist in the immediate project area.

3.10 Noise

Existing noise sources in the project area are from agricultural and recreational activities, traffic on State Highway 357, and birds and animal life.

3.11 Air Quality

The air quality in the area is generally considered good. Significant reductions in visibility are generally weather related.

3.12 Transportation Facilities

The primary transportation facilities in the project area include State Highway 357, gravel county roads and several non-improved dirt access routes.

3.13 Socio - Economic

Economic activity:

Economic activity is almost entirely dependent on agriculture, with livestock production, grazing, hay and alfalfa being the major local commodities. Logging and mining occur in the nearby Beaverhead-Deer Lodge National Forest and other state and private land in the area. Other economic activity is generally associated with the recreational use of the reservoir and surrounding area.

Employment:

Agricultural and agricultural related business account for the majority of the jobs in the area. Logging, mining, recreation and service sector businesses and government account for the remainder of the job base in the region.

Recreation

Recreational use at the Ruby River Reservoir is light to moderate, with fishing the most common activity. Angling use varies depending on the local water conditions. According to the DFWP Angling Use Survey, 1,634 angler days were recorded in 2005. A primitive BLM camping and day use area exists on the east shore of the reservoir. A primitive, gravel boat launch is also located at the BLM site. Other recreational activities in the area include boating, camping, picnicking, swimming, hunting, and wildlife viewing.

Communities:

Towns in the vicinity of the project include Alder (population 116), located 10 miles north of the dam, Sheridan (population 659), located 21 miles northwest of the dam, Virginia City (population 130), located 20 miles northeast of the dam, and Twin Bridges (population 400), located 30 miles northwest of the dam.

Risks / Health Hazards:

The Ruby River Dam has been classified as high hazard. A high hazard dam is one whose failure would endanger lives. This classification is not a reflection of the actual condition of the dam; however, an inspection of the structure completed in 1981 by the Army Corps of Engineers classified the dam as “unsafe and in need of repair” due to deterioration and inadequate spillway capacity.

Emergency Response / Emergency Evacuation Plans

An Emergency Action Plan developed by the SWPB of the DNRC is in place, per Montana Dam Safety Act requirements.

Public Services / Taxes / Utilities:

Public services and utilities in the area include routine road maintenance and repair, police and fire protection, and electrical and telephone service. A small rural hospital is located in Sheridan. The local tax base is primarily dependent upon agricultural land uses, outdoor recreation, government and related businesses.

4.0 - ENVIRONMENTAL CONSEQUENCES

This chapter is organized in the same order as Chapter 3.0, with the probable consequences of the action alternatives (effects of construction) described for each resource area, along with the probable consequences of the no action alternative. Please note that the probable consequences of the identified action alternatives are similar, since each action alternative would essentially involve the same construction activities in the same sequence. The exception is probable consequences to fisheries, water rights and usage, water resources, socio-economics, topography, soils, and land use, where some differences exist. This is due to several action alternatives that would raise the storage capacity of the reservoir. This is discussed in detail in each respective section.

The assessment of potential consequences is based on previous dam rehabilitation projects and their associated impacts, and/or issue specific references and evaluation methods, which are identified in the Reference Section 8.0.

4.1 Geology

EFFECTS OF NO ACTION

No effect

EFFECTS OF CONSTRUCTION

No effect

4.2 Topography

EFFECTS OF NO ACTION

The potential for failure of the dam in the event of a major flood episode would be high due to the existing serious structural deficiencies with the spillway. Topography would be altered downstream from the dam in the event of it's failure due to the severe channel erosion and scouring that could occur from floodwaters.

EFFECTS OF CONSTRUCTION

Effects of construction on topography would be minor and localized. The borrow area would be disturbed due to the removal of material for the cut and fill operation. The spillway and outlet areas of the dam will also experience disturbance because of the construction. Approximately 20 acres would be disturbed immediately surrounding the dam. Effects to topography from the construction are negligible and non-significant in the long term. Effects to topography from the increased storage vary depending on the alternative, as follows:

Alternative B - Raising the spillway crest elevation to 5,400 would flood an additional 167.46 acres of land, primarily at the reservoir's upper end. Topography in the newly inundated area would be altered due to seasonal flooding. Some locations around the reservoir shoreline could be more susceptible to increased erosion from wind and wave action due to the higher full-pool elevation. The 500-year flood elevation of 5,404 would inundate an additional 61.7 acres. These impacts would be non-significant in the short and long term.

Alternative C - Raising the spillway crest elevation to 5396.7 would flood an additional 56.18 acres of land, primarily at the reservoir's upper end. Topography in the newly inundated area would be altered due to seasonal flooding, although to a lesser extent than alternative B. These impacts would be non-significant and negligible in the short and long term.

Alternative D – No impacts would occur other than the site disturbance associated with the spillway, drains, terminal outlet structure and access road construction, totaling approximately 20 acres.

Under all action alternatives, disturbed areas associated with the dam rehabilitation construction would be reclaimed and reseeded upon project completion.

4.3 Water Resources

Ground Water:

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

Depending on surface and subsurface soil material, groundwater surface elevations would be expected to increase in the immediate vicinity of the shoreline from higher reservoir water levels. Long-term impacts to groundwater from increased reservoir water levels would be negligible and non-significant. Localized impacts to domestic wells could be experienced if they are in close proximity to the reservoir. These potential impacts could be off-set by the drilling of new wells, if needed.

Surface Water:

EFFECTS OF NO ACTION

The reservoir would be lost should the dam fail.

EFFECTS OF CONSTRUCTION

Short-term impacts to reservoir and downstream water quality may occur due to possible increases in turbidity during construction. The effects would be minimized by the majority of work being performed above the water level, and the placement of erosion control structures. Long-term impacts are negligible and non-significant. Historic minimum flows would be maintained throughout the duration of the project to the greatest extent possible (see section 6.2 on page 35). Low flows have been experienced in the past several years due to an extended, severe drought. The action alternatives C and B would potentially increase surface water quantity (see table 1, page 9). Action alternative D would have no effect on water quantity.

Wetlands:

EFFECTS OF NO ACTION

The risk of dam failure related impacts to downstream wetlands and aquatic resources would increase over time under the no action alternative.

EFFECTS OF CONSTRUCTION

The proposed alternative would result in a net increase of approximately 60 new wetland acres, primarily at the upper end of the reservoir. There would be no net loss of wetlands from the proposed rehabilitation and increased storage. The existing wetlands in the upper reservoir area currently vary in size from approximately 100 acres at minimum storage (elevation 5,330.27, 2,600 acre-feet) to 160 acres at maximum storage (elevation 5393, 37,642 acre-feet). The proposed alternative would create the additional 60 wetland acres at the new full pool elevation of 5,400 feet, 45,115 acre-feet of storage. It is estimated that a total of 220 wetland

acres would exist at the new full pool elevation. No other wetland in the construction area or in the vicinity of the reservoir would be would be significantly impacted by the proposed rehabilitation project.

No wetlands would be significantly disturbed or negatively affected by the proposed action. The dam repair work would disturb the area around the dam, outlet channel, and spillway. With the relatively small area affected by physical disturbance and operational mitigations, a measurable loss of wetlands is unlikely. Wetlands associated with the reservoir water lines and inlet stream channel would not be negatively affected by the proposed pool increase or associated construction work, as they are subjected to seasonal water level fluctuations on a yearly basis. The proposed construction activities associated with the action alternatives would not threaten other wetlands elsewhere in the watershed due to the distances involved and minor flow and sediment effects.

Alternative C – The effects to wetlands would essentially be the same as the preferred alternative with the exception of the new wetland acres created. It is estimated that 25 to 35 new wetland acres would be created under this alternative at the full pool elevation of 5396.7.

Alternative D – Existing conditions would be unaffected under this alternative since the reservoir storage and acres seasonally flooded would not change.

Additionally, under each action alternative, the planned repairs would greatly reduce the risk of dam failure related impacts to downstream wetlands and aquatic resources.

Wetland values, under all action alternatives, would not be significantly altered as the newly created wetlands would be identical and of similar value to the existing, reservoir dependent wetlands. Wetland impact assessments and acreage calculations are based on satellite and aerial photograph imagery, satellite imagery software, GIS survey data, and wetland assessments from previous and/or similar dam rehabilitation projects.

Water Rights and Reservations:

EFFECTS OF NO ACTION

Water reservations and water rights associated with the reservoir could be affected if no action is taken should the spillway fail due to disrepair or excess stress on system components, such as what would be experienced during a major flood episode.

EFFECTS OF CONSTRUCTION

The preferred alternative B, which calls for raising the crest of the dam 4 feet and establishing the maximum pool elevation at 5,400 feet would provide 45,115 acre-feet of storage, which is an 8,480 acre-foot increase from the existing maximum storage at the top of the flashboards. Updated mapping of the reservoir indicates that 2,200 acre-feet of storage has been lost to sedimentation since the original construction. The original water right would be restored, and an additional 2,665 acre-feet of storage would be available for potential marketing to new uses.

Alternatives C, raising the principal spillway crest to elevation 5,396.7, would restore existing water contracts with the RRWUA. This alternative gains back all the original water right that was lost due to sedimentation and allows for a minimum pool storage of 2,600 ac-ft. No additional stored water would be available for other uses.

Alternative D would maintain the current pool elevation with no changes in storage.

No negative effects on water reservations and water rights to downstream water users are anticipated with any of the action alternatives. The project would have the beneficial effect of allowing for the continuing use of the reservoir for irrigation and recreation, and allow for the potential marketing of any additional water for recognized and approved beneficial uses.

4.4 Soils

EFFECTS OF NO ACTION

Soils downstream from the dam could be negatively effected from excessive erosion should the dam fail.

EFFECTS OF CONSTRUCTION

Site disturbance would occur during construction, with approximately 20 acres encompassing the proposed construction zone. Some soil compaction may occur due to heavy equipment operation. Approximately 30,000 cubic yards of soil would be used in the cut and fill operation. No significant impacts are anticipated as a result of the construction. Effects would be minor in the short-term due to the majority of the work being performed above the water level and the placement of erosion control structures to minimize any potential surface runoff. Effects are negligible and non-significant in the long-term because of reclamation of all areas disturbed during construction.

Alternative B - Raising the dam crest elevation to 5,400 would flood an additional 167.46 acres of land, primarily at the reservoir's upper end. Soils in the newly inundated area would be altered due to seasonal flooding. Areas around the reservoir shoreline could be more susceptible to increased erosion from wind and wave action due to the higher full-pool elevation. The 500-year flood elevation of 5,404 would inundate approximately an additional 61.7 acres. It is anticipated that these impacts would be non-significant and neglible.

Alternative C - Raising the dam crest elevation to 5396.7 would flood an additional 56.18 acres of land, primarily at the reservoir's upper end. Soils in the newly inundated area would be altered due to seasonal flooding and would be more susceptible to wind and wave erosion, although to a lesser extent than alternative B. These impacts would be non-significant and neglible.

Alternative D – No impacts would occur other than the site disturbance associated with the spillway, drains and terminal outlet structure and access road and trail construction, totaling approximately 20 acres.

Under all action alternatives, all disturbed areas associated with the dam rehabilitation would be reclaimed and reseeded upon project completion.

4.5 Vegetation

EFFECTS OF NO ACTION

Downstream vegetation could be lost from flooding should the dam fail.

EFFECTS OF CONSTRUCTION

Some vegetation will be removed as part of the construction and for equipment access. Effects are negligible in the long-term due to reclamation and replanting / reseeding of all disturbed areas. Approximately 20 acres of vegetation would be affected by the proposed project. Additional acreage would be flooded under the action alternatives B and C. Vegetation seasonally flooded consists of mostly sage, willow, dogwood, cottonwood, and native shrubs and grasses. Some vegetative cover would eventually be lost in these inundated areas, with an increase in exposed ground, potentially causing an increase in wind and wave erosion and dust. These impacts would be non-significant in the short and long term. All areas disturbed by the construction would be reclaimed and reseeded.

Species of Special Concern:

Erigeron parryi (Parry's fleabane), a state species of special concern has been identified in the vicinity of the dam and in upland areas adjacent to the east shore of the reservoir.

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

A preliminary site visit in the spring of 2007 failed to located this species in the immediate project area surrounding the dam. Follow-up site visits along the east shore also failed to locate any Erigeron parryi . It is not anticipated that any of the action alternatives would affect Erigeron parryi since its preferred habitat is above each of the action alternatives proposed full and flood pool elevations and is outside of the construction disturbance zone at the dam.

No other known threatened, endangered or species of special concern will be affected under any of the action alternatives as a result of the construction.

Weeds:

EFFECTS OF NO ACTION

Noxious weeds could be spread by floodwaters should the dam ever fail.

EFFECTS OF CONSTRUCTION

The action alternatives may cause an increase in noxious weeds due to soil disturbance and equipment operation. Effects are negligible and non-significant in the long term due to reclamation and weed control implementation.

4.6 Wildlife

EFFECTS OF NO ACTION

Downstream wildlife and habitat could be lost from flooding should the dam fail.

No effects

EFFECTS OF CONSTRUCTION

Effects would be minor to wildlife in the short-term due to the increased activity associated with the construction. Local wildlife within the immediate vicinity of the project location (e.g. mule and whitetail deer, elk, moose, black bear, mountain lion, raptors, song birds, waterfowl) would most likely avoid the immediate work area during construction. This impact would be minor, non-significant and end upon project completion. All non-significant but potentially adverse impacts to fish and wildlife resources will be temporary, minor, short-term and end upon completion of the project. Long term impacts to wildlife are negligible and non-significant. It is anticipated that the increased flooded acreage associated with the action alternatives would not significantly affect wildlife habitat surrounding the reservoir.

Species of Special Concern:

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

An active bald eagle nest is located on private land approximately 2 miles southwest of the dam. No other threatened, endangered or species of special concern have been observed within the project area. It is not anticipated that the bald eagles would be affected by the construction due to the distance from the construction zone (based on management guidelines in the Montana Bald Eagle Management Plan, July 1994).

No other threatened, endangered or species of special concern would be affected as a result of the construction and action alternatives.

4.7 Fisheries

EFFECTS OF NO ACTION

Downstream fisheries could be negatively impacted should the dam fail due to increased turbidity and erosion. The reservoir fisheries would be lost should the dam fail.

EFFECTS OF CONSTRUCTION

Alternatives (B and C) include raising the principal spillway crest from 3 to 7 feet above the existing elevation. The increased storage would potentially benefit reservoir and downstream fishery resources at minimum pools.

Alternative B – Preferred Alternative

The increased marketable storage associated with the preferred alternative (2,665 acre-feet) could benefit downstream fisheries by providing the opportunity for water leasing to augment in-stream flows.

Alternative D maintains the principal spillway crest at the present elevation (5,393 feet). Storage capacity and reservoir operations will not be changed under these alternatives. New impacts to fisheries resources may occur pending Department review of minimum pool operational levels.

Short-term minor impacts to fisheries in the reservoir and downstream from the dam may occur with all of the action alternatives as a result of a temporary increase in sediments during the construction phase of the project. The effect would be minimized by the placement of erosion control structures to reduce runoff and prevent sediments from entering the reservoir and river, and from all of the work being performed above the water level. Sediments are not expected to reach the levels that resulted in a large scale fish kill in 1994. In-stream flows would be maintained at historic levels (minimum of 20 cfs from November through March) to the greatest extent possible throughout the duration of the project to protect downstream fisheries resources. There would be instances during construction when flows from the dam would be temporarily halted. These shutdowns would be no longer than 8 hours. Downstream fisheries monitoring would be required during these shutdowns to insure impacts are minimized. Impacts to fisheries would be minimized by coordinating with the DFWP on shutdown timing, scheduling and monitoring. The effects would be short-term, temporary and end upon project completion. Long-term impacts to fisheries are negligible and non-significant. Table 2 provides stream flow data for the Ruby River below the dam from 1963 to 1993 (pre consent decree flows).

Table 2

USGS Stream Gage Data 1963-1993**

USGS 06020600 Ruby River below reservoir near Alder, MT#

Explanation of Parameter Code and dd_nu used in the Statistics Data

# parameter_cd	Parameter Name	dd_nu	Location Name
# 00060	Discharge, cubic feet per second		1

#
#

agency_cd	site_no	parameter_cd	dd_nu	year_nu	mean_va
5s	15s	5s	3n	4s	12n
USGS	06020600	00060	1	1964	216.0
USGS	06020600	00060	1	1965	204.7
USGS	06020600	00060	1	1966	187.9
USGS	06020600	00060	1	1967	189.3
USGS	06020600	00060	1	1968	199.5
USGS	06020600	00060	1	1969	244.9
USGS	06020600	00060	1	1970	265.3
USGS	06020600	00060	1	1971	254.0
USGS	06020600	00060	1	1972	240.0
USGS	06020600	00060	1	1973	201.6
USGS	06020600	00060	1	1974	214.3
USGS	06020600	00060	1	1975	263.6
USGS	06020600	00060	1	1976	264.4
USGS	06020600	00060	1	1977	182.2
USGS	06020600	00060	1	1978	221.1
USGS	06020600	00060	1	1979	193.5
USGS	06020600	00060	1	1980	201.2
USGS	06020600	00060	1	1981	223.9
USGS	06020600	00060	1	1982	250.4
USGS	06020600	00060	1	1983	272.8
USGS	06020600	00060	1	1984	351.9
USGS	06020600	00060	1	1985	189.3
USGS	06020600	00060	1	1986	187.8
USGS	06020600	00060	1	1987	150.2
USGS	06020600	00060	1	1988	155.9
USGS	06020600	00060	1	1989	139.8
USGS	06020600	00060	1	1990	154.1
USGS	06020600	00060	1	1991	154.0
USGS	06020600	00060	1	1992	141.2
USGS	06020600	00060	1	1993	190.4

** This water data represents pre consent decree flows.

Species of Special Concern:

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

No threatened, endangered or species of special concern will be affected as a result of the construction and action alternatives.

4.8 Ownership and Land Use

Land Ownership:

EFFECTS OF NO ACTION

No effect

EFFECTS OF CONSTRUCTION

Alternatives B and C would affect land ownership due to the increased flooded acreage associated with raising the dam and the subsequent increased reservoir storage.

Alternative B - Raising the dam crest elevation to 5,400 would flood an additional 167.46 acres of land, primarily at the reservoir's upper end. The 500-year flood elevation of 5,404 would inundate approximately 61.17 acres. These impacts could be adverse in the short-term, but non-significant and neglible in the long-term.

Alternative C - Raising the dam crest elevation to 5396.7 would flood an additional 56.18 acres of land, primarily at the reservoir's upper end. These impacts could be adverse in the short-term, although to a lesser extent than alternative B, but non-significant and neglible in the long-term.

Alternative D would have no impacts to land ownership since the maximum pool elevation and storage would remain unchanged.

Negotiations related to compensation for landowners affected by the increased storage would be initiated under action alternatives B and C. The state would purchase the flooded acres outright and/or acquire flood easements for the affected property.

Land Use:

EFFECTS OF NO ACTION

The availability and delivery of agricultural irrigation water could be impacted if the spillway is not repaired.

EFFECTS OF CONSTRUCTION

Project implementation will be scheduled to minimize adverse effects to agricultural irrigation. No land use changes would occur at the project site. The newly flooded acres under alternatives B and C would become flood easement property under these action alternatives. Seasonal flooding would occur on this property. It is not anticipated that significant land use changes would occur under the action alternatives. One home on the east side of the reservoir could be adversely impacted by the new full pool level. Mitigation measures are under development to address this issue. The impacts are non-significant in the short and long-term.

Government Regulatory Restrictions on Private Property Rights:

EFFECTS OF NO ACTION

No effect

EFFECTS OF CONSTRUCTION

The proposed action alternatives may involve additional regulatory restrictions on private property through the use of flood easements if the affected property is acquired in this manner. Flood easement restrictions would primarily involve building and sanitation systems. These impacts would involve a relatively small amount of reservoir shoreline property. Although potentially adverse in the short-term, the long-term impacts to landowners and private property rights would be non-significant. Outright fee title purchase of the affected property would not involve any restrictions imposed on property owners. The total area inundated by land owner under the preferred alternative B is summarized below:

TOTAL AREA INDUNATED BY LANDOWNER (ACRES)

Owner Name	**Area Inundated between elevations 5393 to 5400**	**Area Inundated between elevations 5400 to 5404 (500 yr. flood event)**	**Total Effected Area**
Duffner Ranches	2.57	0.85	3.42
Garden Creek Stock Association	62.5	23.34	85.84
William F. Powers Trustee Et Al	4.00	2.22	6.22
Ruby Dell Ranch	0.88	0.93	1.81
Ruby Lake Ranch LLC	9.5	6.65	16.15
Ruby Valley Hydroelectric Authority	13.36	20.74	34.1
State of Montana	0.33	0.29	0.62
USDI Bureau of Land Management	11.18	4.31	15.49
Verhow	1.84	1.63	3.47
MT Dept. of Transportation	0.13	0.21	0.34
Totals	**106.29**	**61.17**	**167.46**

Wilderness:

EFFECTS OF NO ACTION

No effect

EFFECTS OF CONSTRUCTON

No effect (no designated wilderness or wilderness study areas exist in the area)

4.9 Cultural Resources

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

Cultural resource impacts are negligible under Alternatives D, as reservoir operations would not change.

Action alternatives B and C would not cause any significant impacts to any known cultural or historic resources. An on-site survey conducted by the DNRC Archeologist in the spring of 2007 did not find any cultural sites or artifacts around the reservoir shoreline. The dam has been recorded as an historic structure due to its age (site number 24MA350). A cultural resources inventory of the Ruby Dam construction area was completed by Ethos Consultants, Inc. in January 2006.

It is anticipated that the Ruby River Dam will be maintained and operated into the foreseeable future. The general shape and structure of the dam will not be significantly changed with any of the action alternatives. Repairs, maintenance and modifications will be needed over time to protect public health and safety, and to insure the continued use of the reservoir for agriculture and recreation. The DNRC Archeologist has recommended that the dam is eligible for inclusion on the National Register of Historic Places under Criterion A. Any cultural resources discovered will be preserved or mitigated.

Cultural Uniqueness and Diversity:

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

No effects (no unique cultures or cultural diversities would be impacted by the project)

4.10 Noise

EFFECTS OF NO ACTION

No effects

EFFECTS OF CONSTRUCTION

Noise levels will increase temporarily during the construction period. The increased noise will end upon completion of the project. This is non-significant due to the rural nature of the project location.

4.11 Air Quality

EFFECTS OF NO ACTION

No Effects

EFFECTS OF CONSTRUCTION

Some pollutants, odors and dust will occur as a result of construction related equipment operation. The effects will be non-significant and negligible and would end with the completion of the project. An increase in dust could occur under action alternatives B and C due the loss of vegetation from seasonal flooding, mostly at the upper end of the reservoir. It is not anticipated that increases would be significant in the short and long-term. Dust abatement measures could also be initiated if needed to address any problems that may arise from the increase in seasonally flooded acres.

4.12 Transportation Facilities

EFFECTS OF NO ACTION

Portions of State Highway 287 and various county roads downstream from the dam could be flooded should the dam fail.

EFFECTS OF CONSTRUCTION

The action alternatives may result in increased construction related traffic on State Highways 287 and 357. The effect would be minimal and cause no disruptions in regular traffic flow, or create any safety concerns. Traffic control and safety procedures (as recommended by the Montana Department of Transportation and the County Road Supervisor) would be the responsibility of the construction contractor. The effect would be temporary, non-significant and end upon completion of the project.

Alternative B, the preferred alternative would potentially inundate a small portion of two county gravel roads (Garden Creek Road and Cottonwood Creek Road) on the south-west side of the reservoir when the storage is at the new full-pool (elevation 5,400). The placement of a culvert of adequate size and type to allow reservoir water to seasonally flood land on the other side of the county roads, thereby preventing the road from being overtopped, may be necessary. Additional improvements or repairs to the roads may also be required.

Alternative C – It is anticipated that the full pool storage and elevation under this alternative (5,393.7; 41,450 acre-feet) would not affect the county roads.

Alternative D would have no impacts since the maximum pool elevation and storage would remain unchanged.

A Right-Of-Way Permit from the Montana Department of Transportation may be needed due to highway right-of-way land that would be seasonally flooded under action alternatives B and C. It is not anticipated that any repairs or improvements would be needed to State Highway 357. Potential impacts to the highway right-of-way are non-significant and negligible in the short and long-term.

4.13 Socio – Economic

Economic Activity:

EFFECTS OF NO ACTION

Irrigation water flows could be disrupted if the dam's infrastructure is allowed to further deteriorate, thus potentially affecting the agricultural economy of the surrounding area.

EFFECTS OF CONSTRUCTION

The action alternatives (B and C) include raising the principal spillway crest above the existing top of flashboards. The increased storage associated with the action alternatives would potentially provide additional water for recognized and approved beneficial uses. This could have a beneficial effect on the area's agricultural and recreational related economies.

Alternative B would satisfy the original water right, maintain a conservation pool, and provide an additional 3,665 acre-feet of storage for marketing and beneficial uses.

Alternative C would maintain the current conservation pool and satisfy existing water marketing contracts.

Alternative D maintains the principal spillway crest at the present top of flashboards elevation (5,393 feet). Storage capacity and reservoir operations will not be changed under this alternative.

There would be no negative effect to the area's economy from the construction associated with any of the action alternatives. There would be a temporary beneficial increase in economic activity associated with the construction (e.g. motel and local restaurant use, temporary project related jobs, contractor purchases, etc.).

Quantity and Distribution of Employment:

EFFECTS OF NO ACTION

Local jobs related to agriculture could be negatively impacted should the dam fail.

EFFECTS OF CONSTRUCTION

Additional local employment opportunities may result from the construction. The jobs would be temporary in nature and exist for the duration of the project.

Recreation:

EFFECTS OF NO ACTION

Recreational opportunities associated with the reservoir would be lost should the dam fail, or diminished if reservoir restrictions are required due to the dam's deteriorated condition.

EFFECTS OF CONSTRUCTION

Alternative B, the preferred alternative would flood a small portion of the shoreline at the BLM Recreation site on the east side of the reservoir. The primitive boat launch area would also be affected by the increased full pool storage. These impacts would be minor and not effect the use of the recreation site. The boat launch site would still be functional at the new full-pool elevation. The existing vault restroom may have to be moved to a higher location above the new full-pool elevation. A new restroom would be constructed if the existing structure cannot be moved.

Some recreational use may be disrupted by the action alternative construction activities (i.e. fishing, boating, picnicking and camping). The area receives light to moderate recreational use throughout most of the year. Visitors to the area may also experience an increase in noise levels, dust and construction related traffic due to heavy equipment operation. The fishing access area within the construction zone (immediately downstream from the dam) would be temporarily closed for the duration of the project. These impacts are minor, temporary and non-significant in nature and would end with the completion of the project.

Community Impacts:

EFFECTS OF NO ACTION

Alder, population 116, located approximately 10 miles downstream from the dam could be seriously impacted during a flood episode due to the unsafe condition of the spillway, which increases the chances of structural failure of the dam. Other downstream communities that could be adversely impacted from dam failure related flooding include Sheridan (population 659), located 21 miles northwest of the dam and Twin Bridges (population 400), located 30 miles northwest of the dam.

EFFECTS OF CONSTRUCTION

No negative impacts are anticipated. The action alternatives would alleviate the safety issues currently associated with the dam.

Risks / Health Hazards:

EFFECTS OF NO ACTION

Alder, Sheridan and Twin Bridges are located downstream from the dam in the flood inundation zone and could be seriously impacted during a flood, primarily due to the unsafe condition of the spillway, which increases the chances of structural failure.

EFFECTS OF CONSTRUCTION

The risk of failure of the dam would be greatly reduced with the proposed construction under each of the action alternatives. No significant impacts are anticipated to human health and safety related to the increased storage under action alternatives.

Emergency Response / Emergency Evacuation Plans

EFFECTS OF NO ACTION

No effect

EFFECTS OF CONSTRUCTION

No effect - The current Emergency Action Plan will not change as a result of the construction under each of the action alternatives.

Public Services / Taxes / Utilities:

EFFECTS OF NO ACTION

Telephone and power lines could be washed out in various locations should the dam fail.

EFFECTS OF CONSTRUCTION

A power line for a private residence is located at the upper end of the reservoir. Several of the existing power poles are currently flooded seasonally when the reservoir is at full pool. The new full pool elevation would increase the depth at which these poles are flooded, potentially reducing their stability. These poles and the power line may need to be relocated under the action alternatives. These impacts are non-significant in the short and long-term since the line and poles can be moved.

5.0 CUMMULATIVE EFFECTS

The EA to this point has discussed impacts that could result solely from the proposed rehabilitation project. This section will discuss impacts that may occur when the rehabilitation project is added cumulatively to other potential changes or developments.

No specific projects have been identified that, taken cumulatively with the dam rehabilitation, will cause any significant, long-term environmental impacts. Impacts associated with increased stream sedimentation could occur should any new, large-scale mining or logging operations or major road construction occur within the Ruby River drainage. No projects or operations of this nature have yet been identified or are anticipated.

EFFECTS OF NO ACTION

No significant cumulative environmental impacts are anticipated at the present time. The impacts of no action involve increased risks to property and lives downstream and the possible disruption of irrigation water to downstream water users. There would be an increasing danger of dam failure should a major flood episode occur due to the existing inadequate spillway capacity. The no action alternative could also negatively affect the use of the reservoir for recreational purposes. This could potentially have a negative affect to the area's economy, which is heavily dependent on agriculture and outdoor recreation.

EFFECTS OF CONSTRUCTION

All impacts cited are minor, temporary in nature, non-significant, and/or will end with the completion of the project. No cumulative environmental effects of the construction and action alternatives are anticipated. All areas disturbed will be reclaimed upon completion of the project. The project as proposed will not conflict with any local, state or federal laws, regulations or formal plans, and will not establish a precedent or likelihood that future actions with potential significant environmental impacts will be proposed. It is anticipated that the proposed action will not generate any substantial debate or controversy about the nature of any potential or identified impacts. The project as proposed would have long-term positive impacts, as detailed in the comparison table beginning on page 36.

6.0 PREFERRED ALTERNATIVE

6.1 Preferred Alternative B

The preferred alternative is Alternative B, as discussed below, along with an explanation of why this alternative was selected over the other proposed action options.

Please note that the final construction design of the preferred alternative, as implemented, may vary somewhat from that described in the feasibility study. This is normally experienced in projects of this type due to problems and/or issues encountered during construction that necessitate engineering and design changes to fulfill project goals, objectives, and stay within established budgets and schedules. Any variances in the construction design and engineering of the project will not change any of the identified environmental affects or alter the significance of any identified impacts since the construction sequence, disturbed areas, access routes and construction schedule would not change.

Alternative A - No Action

The no action alternative would result in continued degradation of the dam and associated structures, possibly resulting in partial or total failure of the dam in the event of a flood episode, thereby increasing the threat to property and people living downstream. Downstream water quality could be negatively impacted due to the erosion and turbidity that would result from partial or total failure of the dam, with possible negative impacts to aquatic habitats in the Ruby Reservoir and River. Water available for agricultural and recreational uses could also be negatively impacted if no action is taken. The no action alternative is not acceptable due to the ever-increasing risk to the public and property downstream from the dam.

Preferred Alternative B

The preferred alternative would not significantly change existing operations at the project, minimizes any potentially negative environmental impacts to the greatest extent possible, and provides the most economically feasible alternative for rehabilitation. The dam would meet or exceed all current state safety standards with the rehabilitation, plus re-establish the original water right. Additional storage water could be available for marketing for other beneficial uses, such as hydropower, supplementing in-stream flows, etc. The rehabilitation would serve to extend the useful life of the dam for 50-75 years, sustain the area's agricultural economy and allow for the continued provision of important wildlife, fisheries and recreational benefits.

The following excerpt from the HKM Feasibility Study provides a detailed description of the various components of the preferred option:

RUBY DAM PREFERRED REHABILITATION OPTION (from the Ruby Dam Rehabilitation Feasibility Study, HKM Engineering, Inc.)

1.0 INTRODUCTION

The preferred options for rehabilitation of the Ruby Dam spillway and outlet works are discussed in this report as part of the Ruby Dam Rehabilitation Feasibility Study conducted by HKM Engineering Inc. (HKM) for the Montana Department of Natural Resources and Conservation (DNRC). Preliminary design of the preferred spillway crest, spillway chute, stilling basin, raised dam crest, outlet works, and drains are covered in this report.

The preferred rehabilitation option includes raising the spillway crest to elevation 5400 ft, which is seven feet above the existing spillway flashboards. The decision to raise the spillway crest and increase the reservoir storage level was based on the Water Availability Analysis and Economic Evaluation which were performed as part of the Feasibility Study. These analyses showed that raising the storage level of Ruby Reservoir is feasible based on the amount of additional water available on an annual basis (which is currently lost through spillway flows), economic benefit of having additional water available to replenish storage lost to reservoir sedimentation, ability to provide an inactive pool and market water for other future uses.

Preliminary structural design of concrete structures is not included in this report section but is included in the Design Options Summary. The dam raise, drain modifications, and outlet works rehabilitation for the preferred option are also included in this report. Preliminary drawings for the preferred rehabilitation option are included in Appendix A. A detailed cost estimate for the Ruby Dam preferred rehabilitation option is included in Appendix B.

2.0 PREFERRED SPILLWAY OPTION

The preferred Ruby Dam spillway rehabilitation option consists of a 100-ft wide two-cycle labyrinth weir crest at elevation 5400.0 ft with a 100-ft wide chute and stilling basin. Design parameters for this option include:

- Spillway Crest Type/Elevation: Two-Cycle Labyrinth 5400.0 ft
- Spillway Crest and Chute Width: 100 ft
- Rehabilitated Dam Crest Elevation: 5413.0 ft
- Spillway Design Flow: 20,000 cfs (50 LOL outflow)

Details of each component of the preferred spillway option are discussed in the following sections of this report. Drawings are included in Appendix A.

2.1.1 Labyrinth Crest

The spillway crest for the preferred option consists of a 100-ft wide two-cycle labyrinth weir at elevation 5400.0 ft. The labyrinth weir design has a total crest length of 250 ft based on a magnification factor of 2.5, which results in a maximum reservoir elevation of 5409.9 ft at the routed design flood (20,050 cfs). The labyrinth floor elevation was initially set at 5389.0 ft based on the crest elevation and minimum required wall height; due to the existing ground level the floor elevation was lowered to 5385.0 ft which slightly increases the hydraulic capacity of the labyrinth crest. The labyrinth weir spillway crest was designed with the weir projecting into the reservoir to improve approach flow conditions. The preferred spillway crest was set at 5400 ft to maximize the reservoir pool; however a lower crest elevation could be selected during final design based on funding and additional discussions with water users and land owners. Plan and profile drawings are included with the drawings in Appendix A.

2.1.2 Spillway Chute

The spillway chute for the preferred option has a rectangular cross section with slopes that closely match those of the existing chute. The new right and left chute walls were designed to be constructed inside of the existing tapered section with the resulting void between the new and existing walls filled with gravel. Downstream of where the existing chute is less than 100 ft, the chute will be widened by excavating to the left of the existing chute wall and with the new wall constructed approximately 25 ft left of the existing wall. The right chute wall in the widened area will be constructed adjacent and inside of the existing wall.

The top of the chute walls were set at elevation 5413.5 ft in the area of the dam crest so the walls would be 6 inches higher than the dam crest. The walls were then sloped down to a minimum height of I 0 ft; the 1 0-ft wall height is continued until the intersection with the stilling basin walls at elevation 53 10 ft. The minimum wall height was based on the existing ground surface rather than on spillway hydraulics because the freeboard recommended above chute flows required lower wall heights than site topography allowed. Flow depths and velocities at the 20,000 cfs design flow in the 100-ft chute vary from approximately 10.8 ft at 19 ft/s just downstream of the crest to approximately 2.5 ft at 79.5 ft/s at the stilling basin.

Flow through the spillway chute was modeled using a spreadsheet that uses standard step calculations to compute flow depth and velocity at spillway stations.

2. 1 .3 Spillway Stilling Basin

The spillway stilling basin for the preferred option consists of a modified US Bureau of Reclamation Type II basin or combination stilling basin-flip bucket with a width of 100 ft and a length of 50 ft. These dimensions were based on the chute width and the estimated length needed to contain the hydraulic jump for the stilling basin design flow of 4,000 cfs (500-yr flood). Hydraulic jumps for flows greater than the design flow are not contained within the stilling basin and the jump is swept downstream of the basin. When flow through the stilling basin becomes great enough, the basin end sill begins to act as a flip bucket and will project a water jet out of the basin and into the downstream river channel.

The combination stilling basin was modified from the standard Type II basin by lowering the end sill to an elevation one foot above the existing channel floor elevation, removing the dentates from the end sill, and not including chute blocks at the entrance to the basin. To minimize the potential for scour at the dam toe from flows in excess of 4,000 cfs, a 60-ft long, 45 degree wing wall was designed on the left side of the basin outlet. The stilling basin design also included riprap placement along the left bank of the river channel below elevation 5310 ft.

2.2 DAM RAISE

Due to the increased elevation of the spillway crest, raising the dam crest will be necessary to meet the minimum freeboard requirement of 3 ft. The preferred rehabilitation option includes raising the dam crest from the existing elevation of 5410 ft to 5413 ft to meet the required freeboard above the design flood maximum reservoir elevation of 5409.9 ft. The dam raise design consists of removing the top five feet of the downstream portion of the existing crest to 5405 ft. The upstream portion of the dam will be excavated for placement of a Terramesh® or wire-faced Mechanically Stabilized Earth (MSE) wall. Compacted impervious/semipervious material will be used to fill the excavated areas on the dam crest downstream of the MSE wall. Riprap will also be placed over the lower upstream half of the Terramesh®/MSE wall to key the wall into the embankment. The upstream wall allows the dam crest to have a 30-ft width which is adequate for vehicle travel and keeps the up and downstream faces at existing slopes.

2.3 LAND ACQUISITION

Based on available mapping DNRC currently has claims or easements on 1,134 acres of land (DNRC land) at Ruby Reservoir. This area nearly encompasses the surface area of the existing normal full pool at El. 5393. Due to the preferred spillway crest elevation increase to El. 5400, the surface area of the reservoir at full pool is also increased.

For the purpose of this Feasibility Study it was assumed that easements outside of existing DNRC claims and easement areas would need to be acquired for the preferred rehabilitation option. The DNRC will make a decision before final design on the elevation (top of dam, spillway crest, etc.) at which easements will be acquired. Further evaluation of DNRC land claims, the chosen easement elevation along with property appraisals will be needed and likely change any preliminary cost estimates.

2.4 RESERVOIR IMPACTS

The preferred option spillway crest (El. 5400) is seven feet higher than the existing normal full pool elevation at the existing spillway flashboards at 5393 ft. Due to this increase in the normal water surface elevation, several areas of roadway embankment along Highway 357 on the east side of the reservoir may be impacted by undercutting and erosion. To protect the road embankment in these areas, slope protection will be added to the existing roadway embankment from the toe of the embankment up to 3 ft above the spillway crest elevation. The proposed design includes rock riprap slope protection in select areas along the highway embankment with a minimum thickness of two feet. The approximate volume of slope protection required along the highway on the east side of Ruby Reservoir was calculated at 16,200cy. Other modifications to the highway along the east side of Ruby Reservoir should not be necessary as the road surface has a minimum

elevation of approximately 5420 ft. Detailed identification of slope protection requirements is beyond the scope of this study and more detailed evaluation will be necessary during final design.

One small area of potential impact is located along the road embankment near the southwest corner of the reservoir. At this location, the terrain is relatively flat and slope protection may not be required. Although this area may warrant further consideration during final design, slope protection for this area was not included in the quantities used in the cost estimate. The cost associated with reservoir impacts is included in the cost estimate for the preferred option presented in Appendix B.

2.5 DRAIN MODIFICATIONS

To address concerns with the unknown condition of the original drain system, primarily the 12- inch CMP drain located in the east portion of the dam toe, a new drain outfall is recommended to be installed downstream of the junction of the three tile drains. This tile drain junction drains into the CMP conduit which discharges to the stream bed downstream of the spillway stilling basin. This CMP conduit has likely deteriorated over the 70 years since its original installation. In order to gather additional information on the drains and seepage this CMP conduit should be located and a manhole and new discharge to the river channel installed. The manhole should serve as a sediment trap and the outfall should be raised above the stream channel to allow observation of the discharge. Installation of a monitoring well near the center of the dam could also provide some information on drain performance. Investigation of the CMP conduit and monitoring well installation may be completed prior to final design so any data on the condition of the toe drains and seepage can be incorporated into the final rehabilitation design.

3.0 PREFERRED OUTLET WORKS OPTION

The preferred rehabilitation option for the Ruby Dam outlet works consists of salvaging the existing guard gate located in the valve tower, installation of a new 72-in diameter steel penstock through the existing outlet conduit downstream of the valve tower, and installation of one 60-in jet flow gate and one 1 8-in gate valve near the toe of the dam. A new vehicle bridge in the area of the existing downstream foot bridge was included in the design to provide access to the outlet works controls near the dam toe.

This option was the lowest cost of the outlet works options evaluated in the Low Level Outlet Works Rehabilitation Summary that satisfied DNRC discharge criteria. Discharge criteria required the outlet works to perform over a wide range of flows from a maximum of 1,100 cfs at reservoir elevation 5400 ft (preferred spillway crest) to minimum stream flows of 20 cfs. The configuration of the preferred rehabilitated outlet works option is included on the drawings in Appendix A.

PROJECT COSTS

Preliminary cost information for the rehabilitation of Ruby Dam is shown below along with water storage information and the annual cost per acre-foot based on a 75 year project life and 4.5% discount rate. Funding for the rehabilitation will utilize various Montana State government sources of funding. It is anticipated that the DNRC Renewable Resources Grant and Loan (RRGL) program will be utilized for a portion of the funding with water users assessments repaying the loan. Additional state funding will be needed beyond that available from the RRGL program.

RUBY DAM REHABILITATION
PRELIMINARY COST INFORMATION
(2007 dollars)

PARAMETER	PREFERRED REHAB OPTION (L2-100-00)
Spillway Crest Elev.	5,400
Total Storage (AF)	45,115
Total Marketable Storage (AF)	42,515
Estimated Project Cost	$11,930,000
Cost per AF	$264
Annual Cost per AF*	**$12.35**

* Based on 75 yr project life, 4.5% discount rate

5.0 CONSTRUCTION SCHEDULE & SEQUENCE

Rehabilitation construction of the spillway and outlet works at Ruby Dam will require careful scheduling and planning to maintain in-stream flows, water deliveries and protect the work from flooding. Rehabilitation of the outlet must be scheduled to occur outside of the season for water deliveries. It will also be advantageous to restrict the time that the outlet is out of service to coincide with spillway operation to maintain streamflow without pumping water over the dam.

The anticipated schedule is shown in figure 2.

Figure 2 – Proposed Project Schedule

Ruby Dam Reservoir Storage Rehabilitation Project Schedule

Tasks	2007		2008												2009												2010												2011												2012						
	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Planning																																																								
Finalize FS																																																							
EPPs/RRGL																																																							
Land Owner Issues																																																							
Water Rights/Permitting																																																							
Public Comment																																																							
Environmental Assessment																																																							
Environmental Permits																																																							
Choose Preferred Alternative																																																							
Funding																																																							
Legislative Appropriations																																																							
Design																																																							
Design Consultant Selection																																																							
Design Investigations																																																							
Final Design																																																							
Construction																																																						
Bidding and Awarding																																																							
Access Roads																																																							
Outlet Rehabilitation																																																							
Embankment Raise																																																							
Spillway Demolition																																																							
Spillway Construction																																																							
Highway Slope Protection																																																							
Final Construction Report																																																							
Site Closure																																																							

6.2 Proposed Actions to Offset Adverse Impacts:

Surface Water:

The proposed project would include the implementation of erosion and stormwater containment and control measures, including, but not limited to: silt fencing, straw bales, check dams, drain inlet protection, dry ponds, and drainage swales. These structures would be designed to prevent and/or minimize non-point source water pollution. Best management practices would be also implemented, following the guidelines presented in the State of Montana Sediment and Erosion Control Manual (DEQ 1996).

Groundwater:

If it is determined that any domestic wells are negatively impacted by changes in groundwater levels (water quality and/or quantity) from the new reservoir full-pool elevation, mitigation measures will be taken, including replacement wells, if necessary. Currently, one residential well could be affected by the preferred alternative.

Fisheries:

To the greatest extent possible, historic minimum flows would be maintained throughout the duration of the project to protect downstream fisheries resources. Beneficial, non-consumptive marketing of water will be considered through the water rights permitting process. The water rights permitting process will incorporate a separate EA to address this issue. The Consent Decree between the DNRC, RRWUA and DEQ entered into after the 1994 sediment release and subsequent fish kill called for minimum flows of between 20 to 30 csf (from November through March) to protect downstream fisheries. A minimum pool of 2,600 acre-feet was also established. The Consent Decree was terminated by the Montana First Judicial Court in November 2002. To date, the reservoir and dam have been voluntarily managed under the Decree stipulations.

Recreation:

Recreationists would be informed of any hazards associated with the project site by the use of on-site signs. News releases would also be issued and published in local newspapers informing the public of potential hazards or construction related recreational restrictions. The information and hazard signs would be placed in prominent locations that are visible to recreationists. The BLM Campground vault restroom may have to be relocated to higher ground above the new full-pool elevation of 5,400 feet. A new restroom would be constructed if the existing structure cannot be moved. Any other damage to the campground or BLM facilities would also be repaired or replaced with new facilities, as needed.

Land Use: Flood easements and/or the purchase of flooded private property would be negotiated with all affected landowners. One home on the east side of the reservoir could be adversely impacted. Mitigation measures are currently under development.

Air Quality: Dust abatement measures would be initiated if significant increases in dust from newly exposed ground adversely impact private residences in the immediate vicinity of the reservoir, primarily at the upper (south) end.

Transportation Facilities: Sections of the county roads (Garden Creek and Cottonwood Creek) adversely impacted by the project would be repaired and/or reconstructed as necessary. Additional riprap will be placed and slope protection measures initiated along the State Highway 357 right-of-way in areas that would be susceptible to increased wind and wave erosion. It is not anticipated that any other repairs or improvements would be needed to State Highway 357.

Vegetation: Weed control measures would be initiated in the construction area as part of the reclamation and reseeding process. Future weed control at the dam would continue to be the responsibility of the RWUA.

Utilities: The existing power poles at the south end of the reservoir that are seasonally flooded at full pool may have to be relocated. Three to four utility poles and a single residential service line may have to be rerouted due to the preferred alternative full pool water levels.

6.3 Need for an EIS

Because no significant impacts were identified, DNRC believes this EA would be sufficient to comply with the MEPA and that an EIS will not be required. A comparison table for the action alternatives and the no action alternative follows. Note that all identified minor and/or potentially adverse but non-significant impacts are short-term and would end upon, or shortly after, completion of the project.

Comparison Table – No Action and Action Alternatives:

RESOURCE	**ALTERNATIVE**		
	No Action		**Action – Reason(s) for Action Alternative Impact Assessment**
Geology	None		None
Topography	Potentially Adverse		Minor –Localized impacts limited to construction site only. Relatively small scope/scale of project (20 acre disturbance).
Water Resources			
Groundwater	None		Minor – Higher reservoir water levels may affect one domestic well, which would be replaced if needed. No other ground water impacts would be noticeable.
Surface Water	Potentially Adverse		Minor – Use of BMPs, work being performed above water levels, maintaining historic minimum downstream flows; limited gate shutdown time.
Wetlands	Potentially Adverse		Minor – Wetland functions will remain unchanged. Results in net increase in wetland acres.
Water Rights	Potentially Adverse		Minor – Makes up for lost storage and allows full allocation of water to RWUA according to water purchase contracts. Requires new permits for new storage to be used for other beneficial uses.
Soils	Potentially Adverse		Minor – Localized impacts to construction site and reservoir shoreline that would be flooded at new full pool. .
Vegetation	Potentially Adverse		Minor – Small scope and scale; vegetation would be removed at dam construction site. Some shoreline vegetation would be flooded at new full pool.
Species of Special Concern	None		None
Weeds	Potentially Adverse		Minor – Disturbed areas would be susceptible to new infestations. Weed control measures would be implemented and will mitigate potential impacts.
Wildlife	None		Minor – Wildlife impacts would be temporary and end with project completion. Local wildlife would most likely avoid construction area.

Fisheries	Potentially Adverse		Minor – Increased turbidity and low flows downstream and in the reservoir would temporarily and adversely affect fisheries. Impacts would be minimized by maintaining historic flows (to greatest extent possible), limiting gate shutdowns, project scheduling (based on DFWP recommendations) and implementing BMPs. Impacts are temporary and would end upon project completion. Impacts are non-significant in the short and long term due to small scope and scale of downstream fisheries impacts.
Species of Special Concern	None		None
Ownership/Land Use	Potentially Adverse		Minor – Shoreline property impacted is limited to 167.46 acres and a relatively small number of landowners. Land uses related to agriculture and recreation would not change. Affected landowners would be compensated. One home on the east side of the reservoir could be adversely impacted. Mitigation measures are currently under development. Impacts are non-significant in the short and long-term due to small scope and scale.
Cultural Resources Unique/Diversity	None		None
Noise	None		Minor – Increase in construction related noise would be temporary, localized and end upon project completion. Impacts are non-significant.
Air Quality	None		Minor – Air quality impacts related to construction would end upon project completion. Potential increases in dust from exposed soil could be mitigated by dust abatement measures, if needed.
Transportation	Potentially Adverse		Minor – Small scope and scale; A small section of a primitive county road (approximately 200 feet) on the west side of the reservoir could be flooded at the new full pool. The road could be protected by an earthern berm and culvert, if needed. Additional riprap and slope protection would be needed in localized sections of the State Highway 357 right-of-way.
Socio-Economic	Potentially Adverse		Minor – See economic activity.
Economic Activity	Potentially Adverse		Minor – The construction may bring some short-term employment opportunities and increased local economic activity related to the project. Long-term economic benefits would be experienced by recreational and agricultural economic activity related to the dam, reservoir and Ruby River.
Quantity / Distribution of Employment	Potentially Adverse		Minor – See economic activity.
Recreation	Potentially Adverse		Minor – Short-term adverse impacts to recreational use would be experienced. These impacts would be localized to the reservoir and several miles downstream from the dam and would be small in scope and scale. These impacts would end upon project completion. Recreational facilities at the BLM campground could be impacted from the new high pool level and may have to be replaced or relocated. All impacts are non-significant.
Communities	Potentially Adverse		Minor - See economic activity.
Risks / Health Hazards	Potentially Adverse		None

Emergency Response / Evacuation	None		None
Public Services Taxes / Utilities	Potentially Adverse		Minor – Several utility poles and a domestic electrical service line may have to be relocated at the south end of the reservoir due to the new full pool level. This impact would be localized and small in scale. No other utilities would be affected.
Cumulative Impacts	Potentially Adverse		None

6.4 Project Implementation

It is anticipated that this project will be completed with a traditional design-bid-build sequence. The DNRC State Water Projects Bureau will manage the project. A single prime contractor selected through a competitive bidding process will complete the construction. The DNRC State Water Projects Bureau will provide staff for management and oversight of the project. The details of the administration and schedule will be refined during final design. Figure 2 on page 34 provides a proposed project schedule.

6.5 Monitoring

The Montana Dam Safety Act (85-15-110 MCA) requires that all high hazard dams be annually inspected for compliance with current state safety standards and structural soundness. A more thorough and detailed inspection by a qualified engineer (licensed in Montana) is required every 5 years. Standard engineering practice calls for daily and weekly monitoring of a dam during the first filling immediately after a major rehabilitation.

7.0 GLOSSERY of TERMS

100-year flood: The 100-year flood is a flood event that has a one-in-100 chance of being equaled or exceeded in any year.

500-year flood: A flood even having a one-in-500 chance of being equaled or exceeded in any year.

Acre-foot: The volume of water that would cover an area equivalent to 1 acre, 1 foot deep, or 43,560 cubic feet (325,851 gallons).

Aggregate: Sand and gravel materials used to make concrete or roller-compacted concrete or used to surface roads.

Aquatic Habitat: The place in which water-dependent plants or animals normally live.

Aquifer: A water-bearing layer of permeable rock, sand, or gravel.

Best Management Practices (BMPs): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources.

Borrow source: An excavated area where material may be mined/removed for use as fill at another location.

Breach: A break in a dam embankment created by erosion of the embankment materials or by excavation to remove a portion of a dam. A catastrophic breach would be due to dam failure and would release the entire storage content of the reservoir in a brief period. A controlled breach would drain the reservoir to reduce the storage capacity over an extended period.

CFS: Measure of water flow rate in cubic feet per second. One cfs is equal to about 450 gallons per minute.

Chute: The face or channel of a dam's spillway.

Conservation Pool: Beneficial use of stored water for fisheries, downstream flows, etc. Voluntarily set at 2,600 acre-feet for Ruby Reservoir.

Crest: The top face of a dam's spillway or dam itself.

Cubic yard: Volume measurement used in construction equal to a 3-foot cube or 27 cubic feet or 202 gallons.

Cumulative effects: A general estimation of the effects of project impacts in combination with other past, present, and reasonably foreseeable future developments.

Emergency spillway: A spillway structure used to pass infrequent or large flows. Earth-lined emergency spillways may suffer damage from use.

Endangered species: A wildlife species that is listed by the U.S. Fish and Wildlife Service as being in danger of extinction throughout all or a significant portion of its range.

Enhancements: Measures taken to improve natural and man-made resources.

Floodplain: Land that may be submerged by flood waters; a plain built up by stream deposition.

Full pool: Reservoir at spillway crest.

High hazard: A dam whose failure would result in the loss of life; not a statement of condition.

Inflows: Water flowing into a reservoir.

Lithic: Relating to or made of stone.

Long-term impact: Impacts that occur beyond the actual construction timeframes.

Mitigation: Measure taken to lessen an impact.

Outflow: Releases from a project made through the outlet works or spillway.

Prehistoric: Existing in times predating written history.

Primary gate: Gate in the outlet works of a dam used to make normal releases.

Probable maximum flood: The largest possible precipitation event expected in an area based on the most severe combination of meteorological conditions that are considered reasonably possible for the drainage basin under study.

Secondary gate: Gate in the outlet works of a dam reserved for emergency operation or used during maintenance of the primary gate.

Spillway: Structure used to discharge large quantities of water around the dam without damaging the dam.

Spillway Design Flood: The peak flood flow used to size the maximum discharge capacity of a dam project.

Stilling basin: An open structure or excavation at the foot of a chute or spillway to reduce the energy of the descending stream.

Threatened species: A wildlife species that is federally listed because it is likely to become endangered in the near future.

Total maximum daily load (TMDL): In practice, TMDLs are water quality restoration targets for point and non-point pollution that are contained in water quality restoration plans or in a permit.

Turbidity: Condition of water carrying suspended sediment.

Wetlands: Lands that are generally covered by shallow water or where the ground water table is very close to the surface. Wetlands are generally defined as marshland and riparian habitat.

8.0 REFERENCES

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Consultation with the U.S. Army Corps of Engineers, Helena MT. Regulatory Office, February 2008

Consultation with the MT Department of Environmental Quality, Water Protection Bureau, Helena, MT. February, 2008

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Consent Decree, Judgment and Order concerning the Operation of Ruby River Dam and Reservoir. Montana First Judicial District Court, Lewis and Clark County, May 1995.

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Phase 1 Inspection Report, National Dam Safety Program – Ruby Dam, Alder MT, Madison County, MT, HKM Associates, under contract for the U.S. Army Corps of Engineers, Seattle District, and April 1980.

Climax Vegetation of Montana Based on Soils and Climate, U.S. Dept. of Agriculture, Soil Conservation Service, Bozeman, MT. September 1976

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Section 4.3 - Water Resources References / Methods used for Analysis.

Previous rehabilitation project impacts as detailed in the Tongue River Dam Rehabilitation EIS, DNRC, US Bureau of Reclamation and Northern Cheyenne Tribe, March 1996 and the Middle Creek Dam Rehabilitation EA, HKM Associates, prepared for the DNRC, December, 1986.

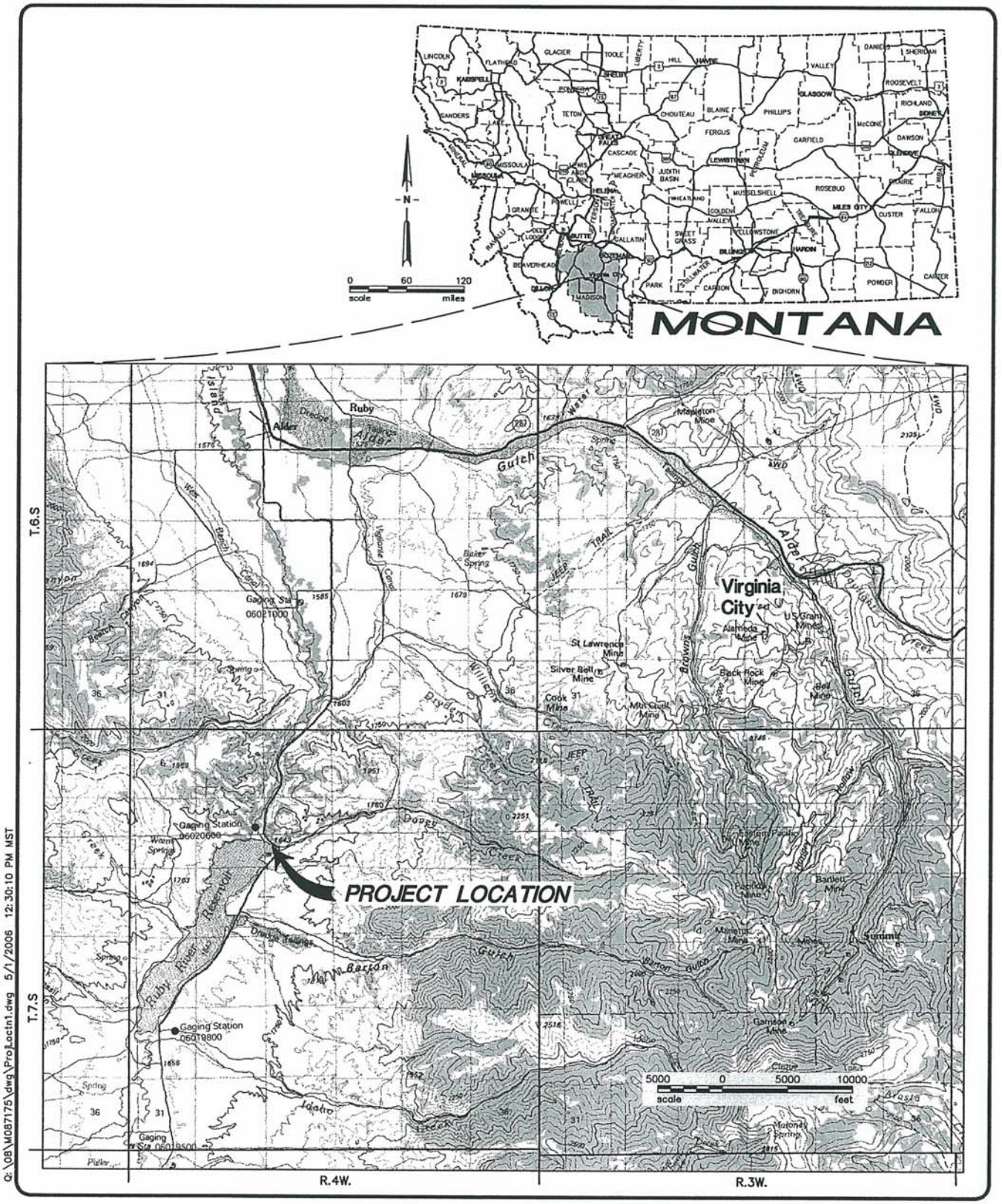
MT DEQ report: The Ruby River Watershed Total Maximum Daily Loads and Framework for a Water Quality Restoration Plan, December 2006.

Wetlands and flooded acreages and impacts associated with the action alternatives were identified and evaluated using air and satellite photography, GIS survey data and satellite imagery software, and previous impacts experienced in the Tongue River Dam and Middle Creek Dam Rehabilitation Projects.

9.0 LIST OF PREPARERS

Jim Domino, DNRC – natural resources, socio-economic issues/impacts, MEPA compliance
Dolores Eustice, DNRC – editorial review, EA distribution
Brian Grant, DNRC – engineering review/information, site evaluation, construction timeframes
Rob Kingery, DNRC - budgets, project timeframes, engineering review, administrative oversight
Tim Kuehn, DNRC – land issues and easements
Randy Laskowski, DNRC – budgets, project timeframes, grants and funding information
Kevin Smith, DNRC - budgets, project timeframes, engineering review, administrative supervision
HKM Engineering – Feasibility Report

Appendix A: Construction Diagrams



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RUBY DAM REHABILITATION FEASIBILITY STUDY

PROJECT LOCATION MAP

FIGURE 1

HKM ENGINEERING

8M087.175 | AUGUST 2007

SURVEYORS NOTE:

1. THE VERTICAL DATUM FOR THIS PROJECT IS THE CENTERLINE AT THE TOP OF THE SPILLWAY BEING 5392.00.

2. THE HORIZONTAL COORDINATE SYSTEM FOR THIS JOB IS BASED ON 4 ORIGINAL AERIAL TARGET POINTS AROUND THE RUBY RESERVOIR (POINTS 9, 15, 18, AND 20).

3. FIELD SURVEYS WERE PERFORMED IN OCTOBER AND NOVEMBER OF 2005 USING GPS.

4. THE LAT/LONG FOR CONTROL POINT NUMBER 1 IS:
LATITUDE: 45.141856443
W LONGITUDE: 112.062577079
ELLIPSOID HEIGHT: 5397.8642'
NAVD ELEVATION: 5431.28' (LOCAL ELEVATION IS 5427.31')
ROTATION FROM GPS NORTH AT CP 1: -0 deg 05'45.484311"
(OPUS SOLUTION ON 10-25-05)

5. NO NGS BM'S WERE SURVEYED.

6. THE OUTLET CHANNEL WAS SURVEYED ON NOVEMBER 30, 2005 AFTER THE WATER WAS SHUT OFF. CONTOURS WERE GENERATED FROM THE OUTLET TO THE CONFLUENCE OF THE RIVER CHANNEL BELOW THE DAM. THE DEEPEST AREA DIRECTLY DOWNSTREAM FROM THE OUTLET STILL COULD NOT BE MEASURED, AND IS LIKELY DEEPER THAN SHOWN. THE NORMAL WATER LINE (10-05) WAS SURVEYED, ALONG WITH THE LOWERED WATER LEVEL (11-05). BOTH WATER LEVELS ARE SHOWN.

AERIAL MAPPERS NOTE:

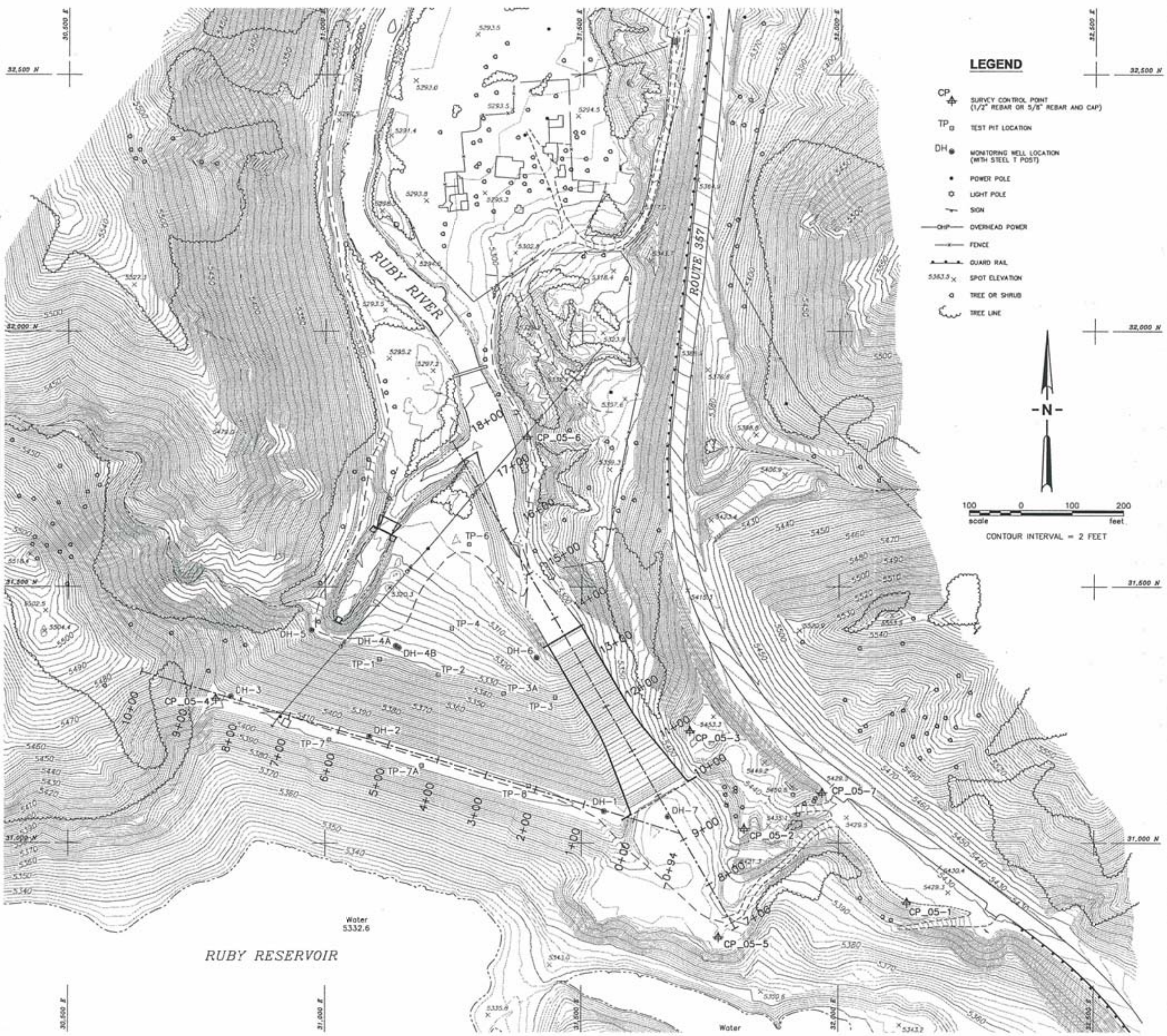
1. SPOT ELEVATIONS IN OBSCURED AREAS ARE APPROXIMATE AND MAY NOT MEET NATIONAL MAP ACCURACY STANDARDS.

SURVEY CONTROL TABLE

CONTROL POINT	COORDINATES	ELEVATION	DESCRIPTION
CP_05-1	N 30883.984 E 32134.611	5427.31	EXIST. PK NAIL IN ROCK
CP_05-2	N 31028.295 E 31815.810	5432.60	1/2" REBAR
CP_05-3	N 31218.664 E 31710.055	5450.24	1/2" REBAR
CP_05-4	N 31281.772 E 30786.302	5410.32	5/8" REBAR WITH YELLOW PLASTIC CAP
CP_05-5	N 30816.824 E 31766.593	5388.22	5/8" REBAR WITH YELLOW PLASTIC CAP
CP_05-6	N 31793.268 E 31391.484	5302.89	1/2" REBAR
CP_05-7	N 31097.391 E 31968.139	5435.68	MONT. DEPT. OF TRANSPORTATION BRASS CAP BENCHMARK

GEOTECHNICAL EXPLORATION HOLE LOCATIONS

DRILL HOLE	COORDINATES	TEST PIT	COORDINATES
DH-1	N 31061.55 E 31543.28	TP-1	N 31358 E 31105
DH-2	N 31206.95 E 31085.37	TP-2	N 31327 E 31218
DH-3	N 31286.10 E 30816.00	TP-3	N 31283 E 31448
DH-4A	N 31384.28 E 31135.98	TP-3A	N 31291 E 31347
DH-4B	N 31380.64 E 31141.64	TP-4	N 31419 E 31246
DH-5	N 31415.62 E 30973.69	TP-6	N 31583 E 31279
DH-6	N 31361.07 E 31411.22	TP-7	N 31201 E 31008
DH-7	N 31051.19 E 31666.48	TP-7A	N 31150 E 31186
		TP-8	N 31111 E 31396



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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

GENERAL SITE PLAN OF EXISTING TOPOGRAPHY
PREFERRED OPTION

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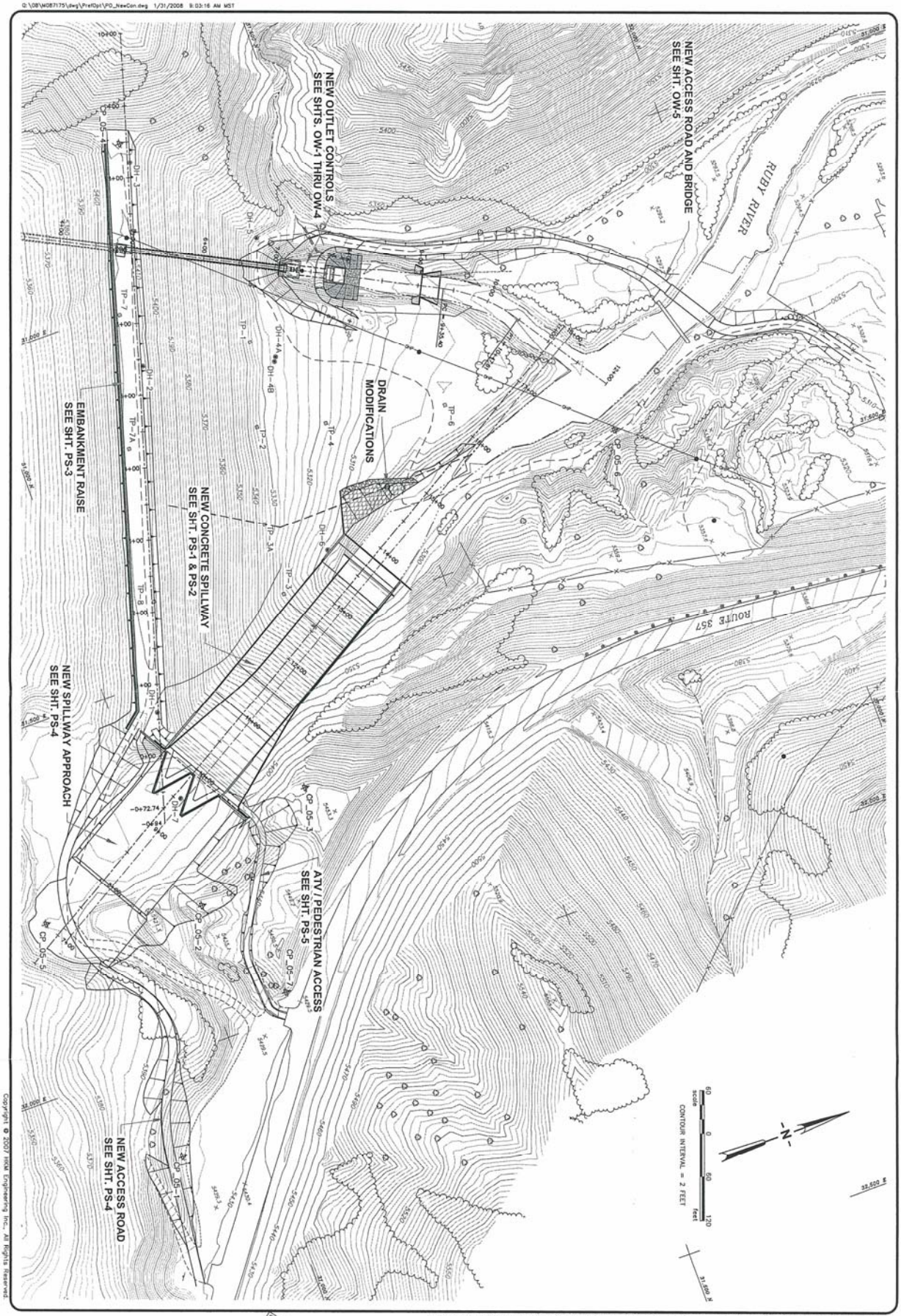

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

SITE PLAN OF NEW CONSTRUCTION FEATURES
PREFERRED OPTION

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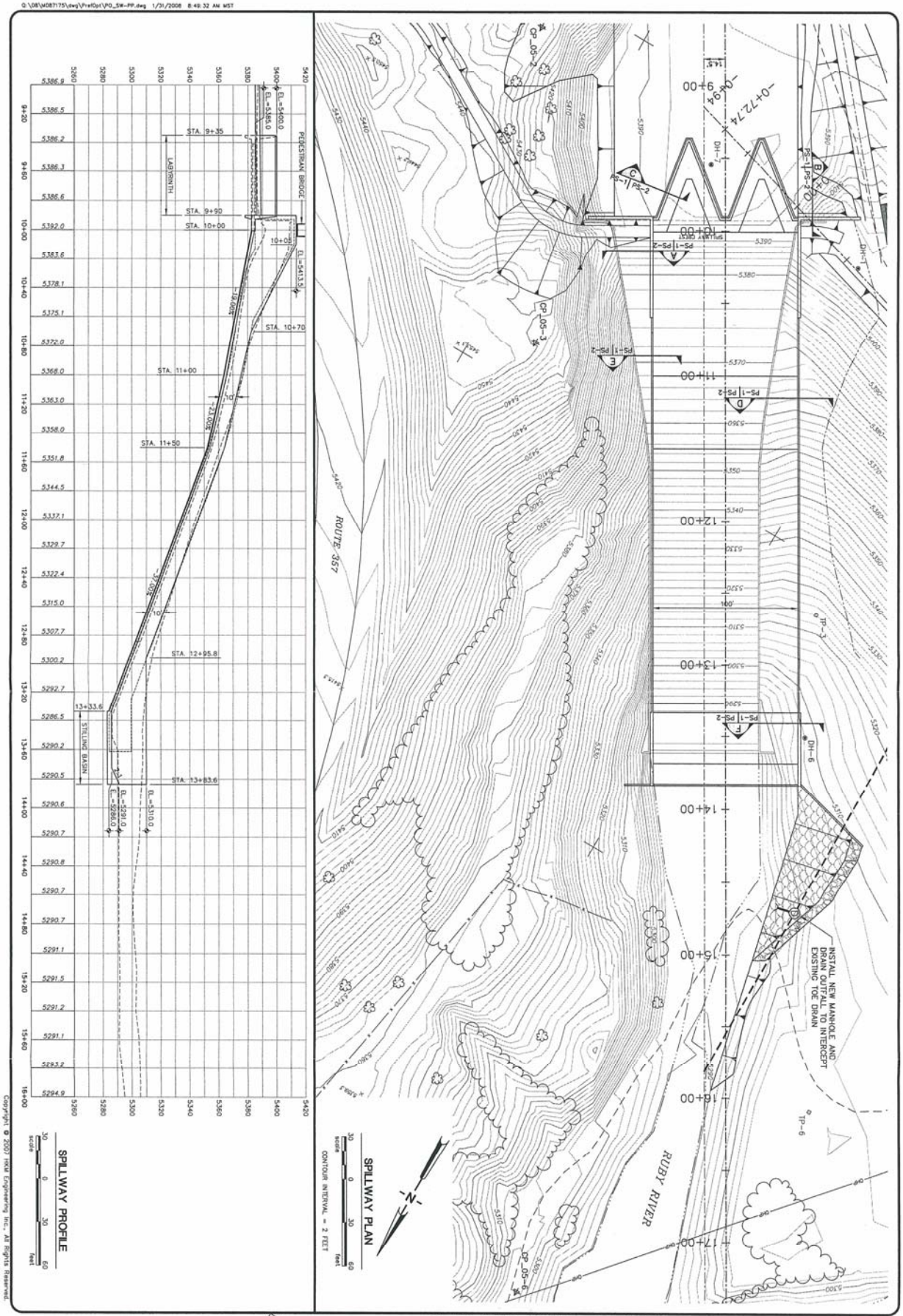

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

SPILLWAY PLAN AND PROFILE
PREFERRED OPTION

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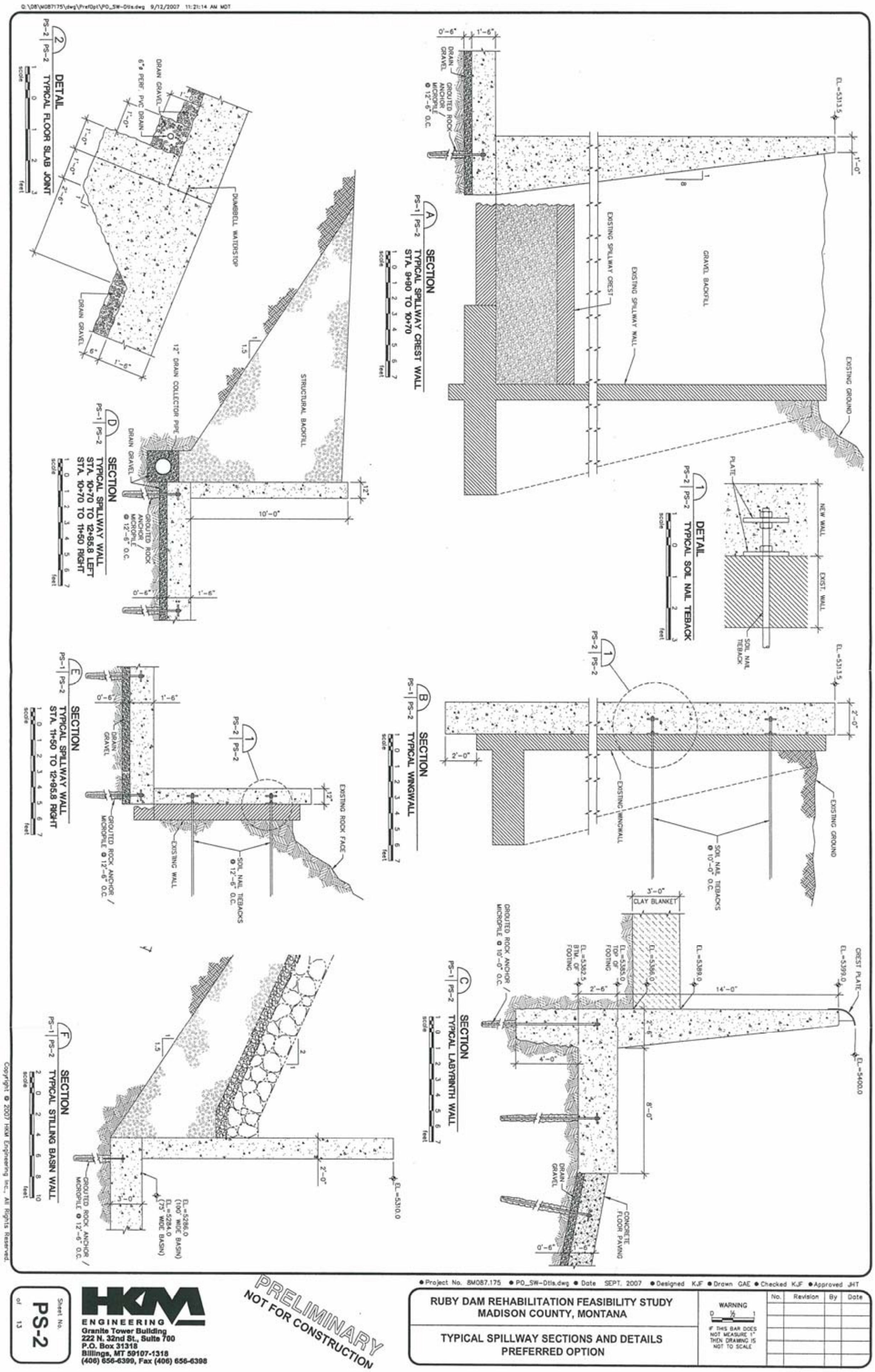
RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA
TYPICAL SPILLWAY SECTIONS AND DETAILS
PREFERRED OPTION
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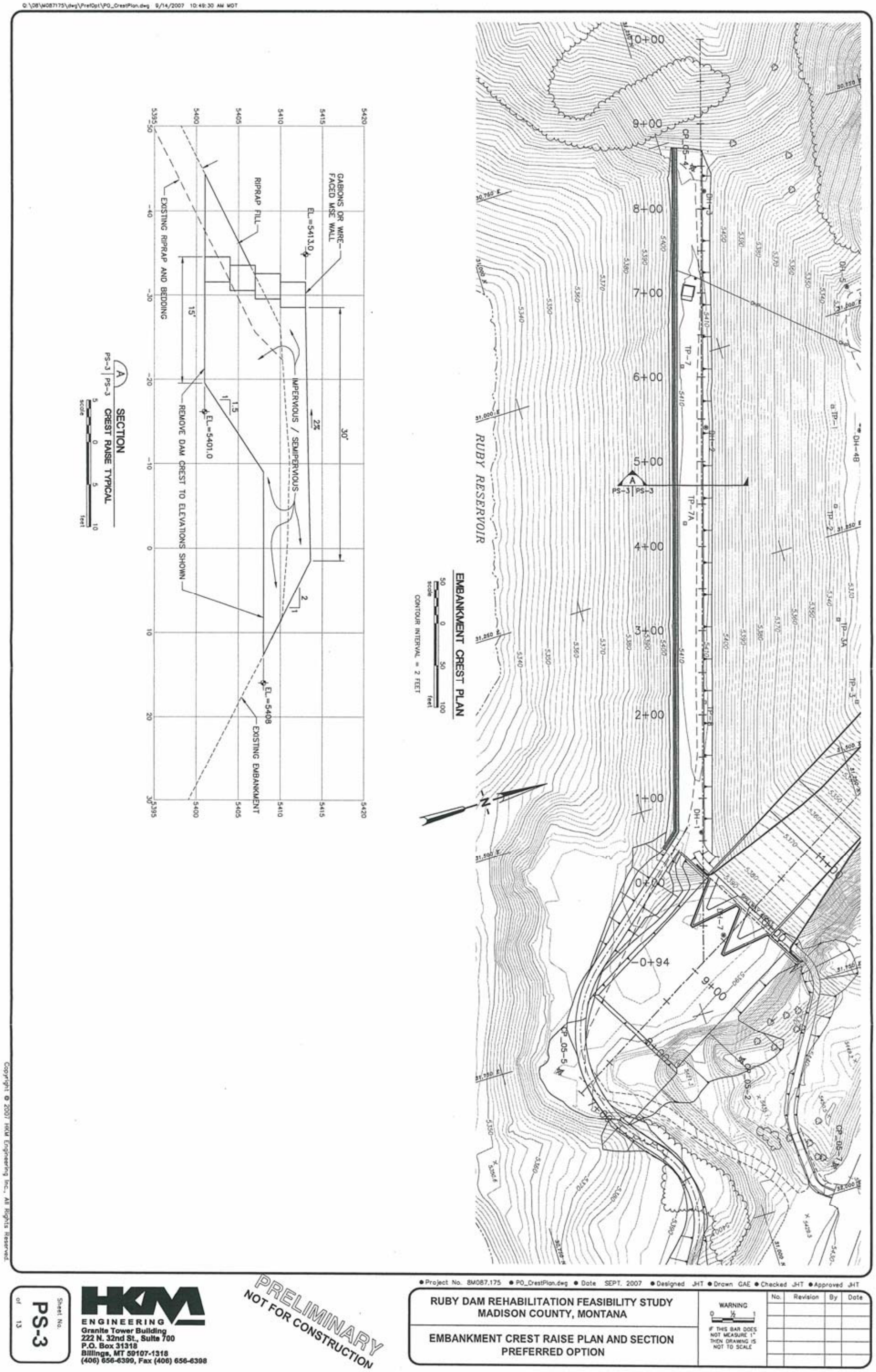
RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA
EMBANKMENT CREST RAISE PLAN AND SECTION
PREFERRED OPTION
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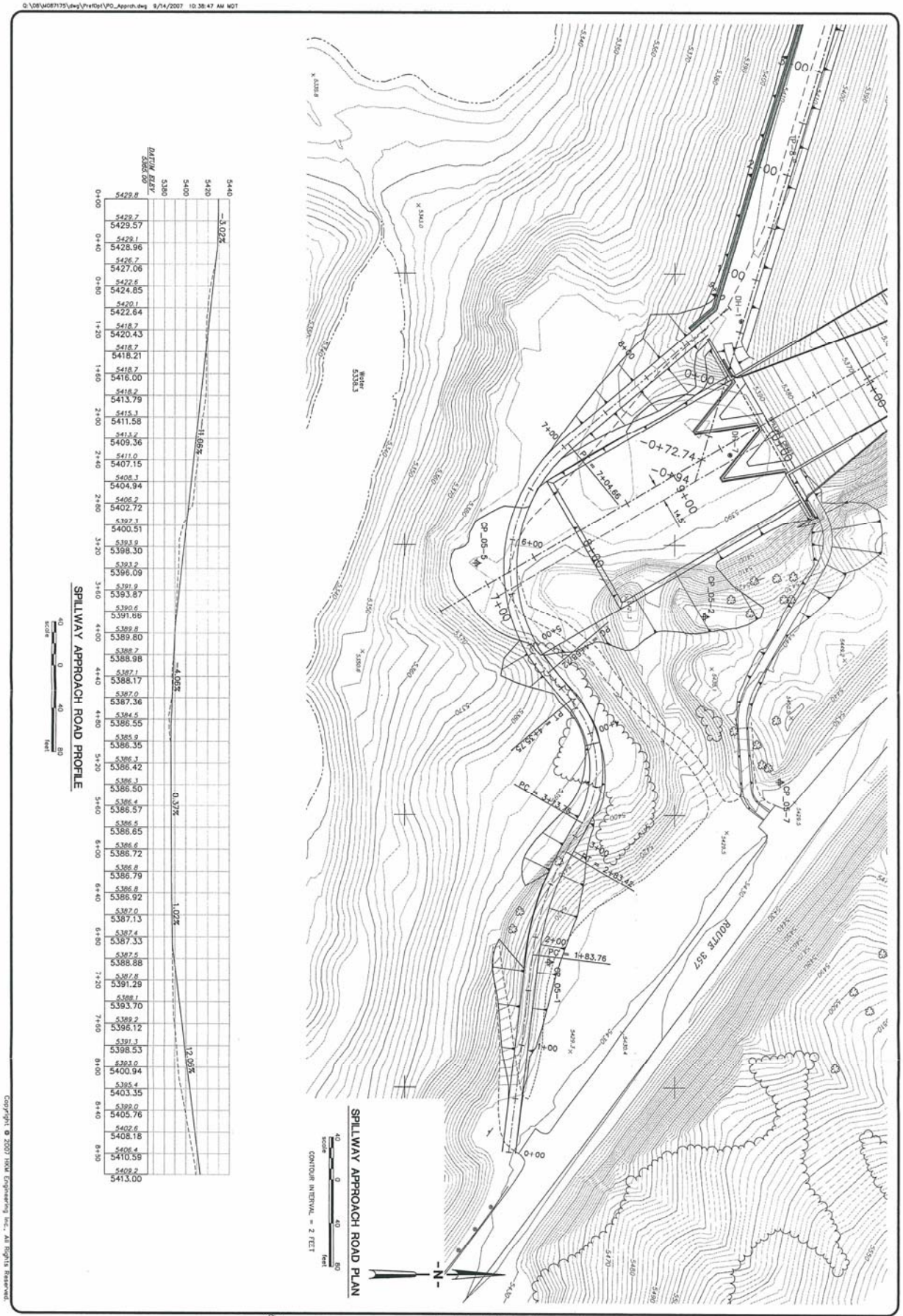

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SPILLWAY APPROACH PLAN
PREFERRED OPTION

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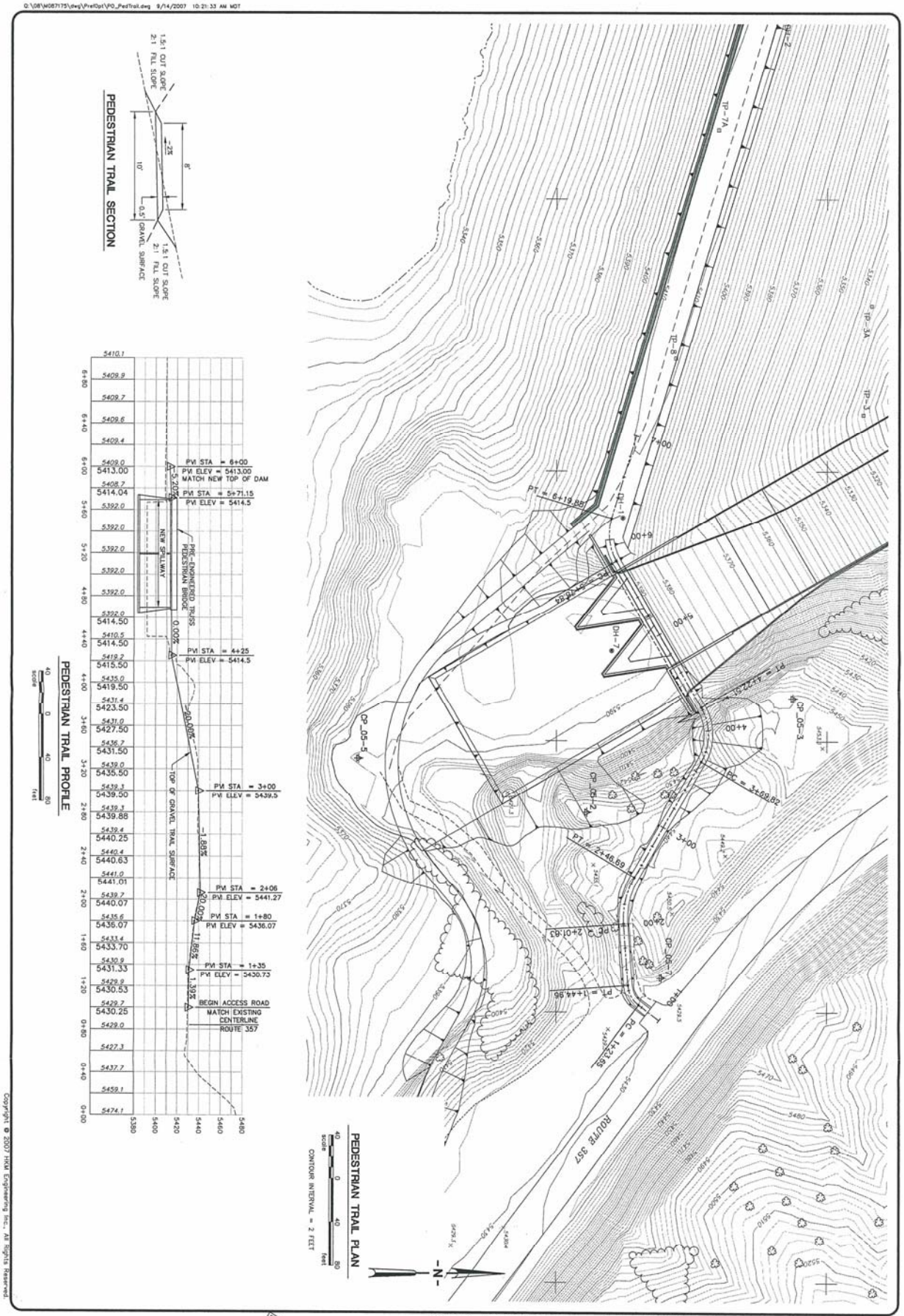

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

PEDESTRIAN TRAIL PLAN
PREFERRED OPTION

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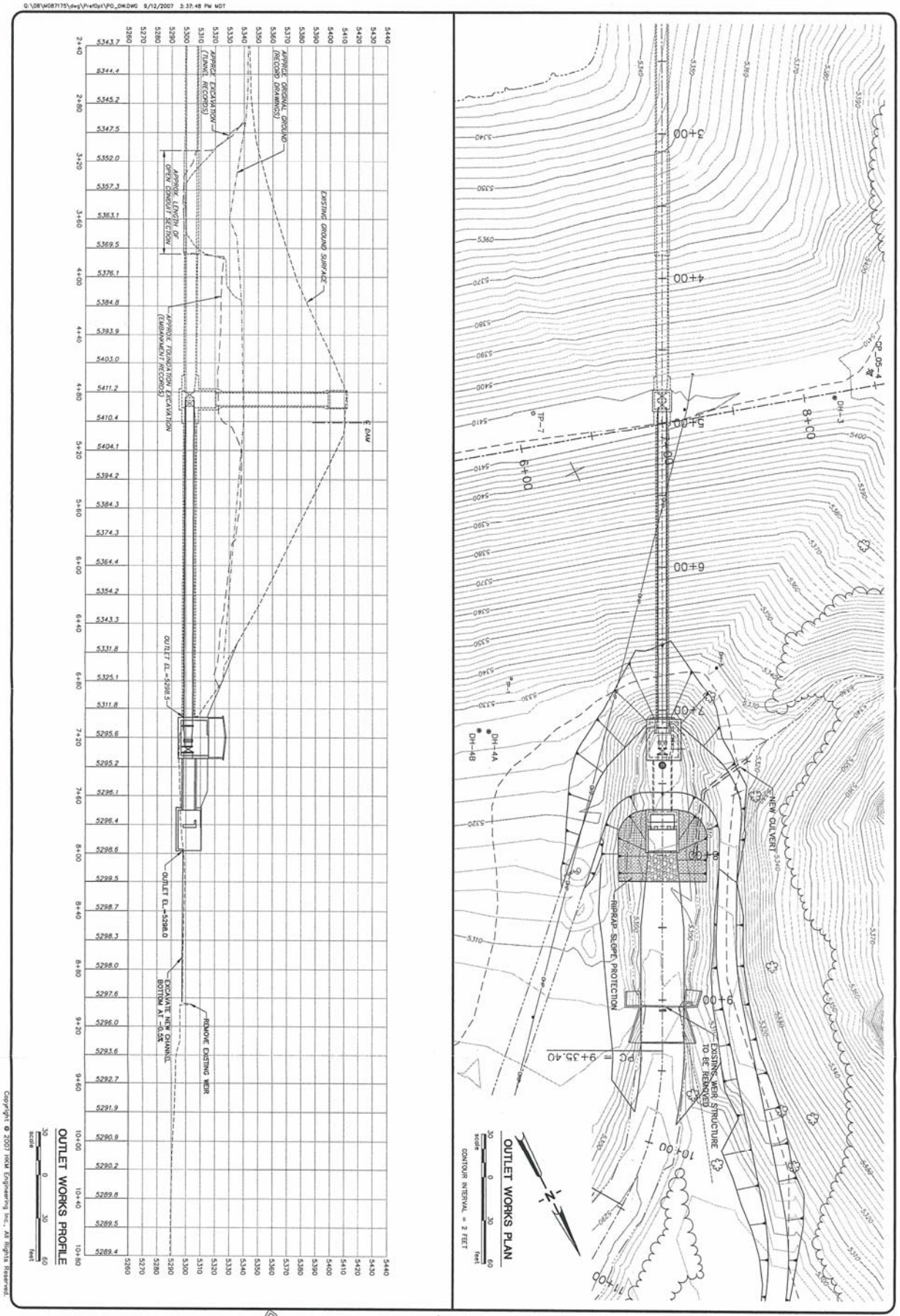

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

OUTLET WORKS PLAN AND PROFILE
PREFERRED OPTION

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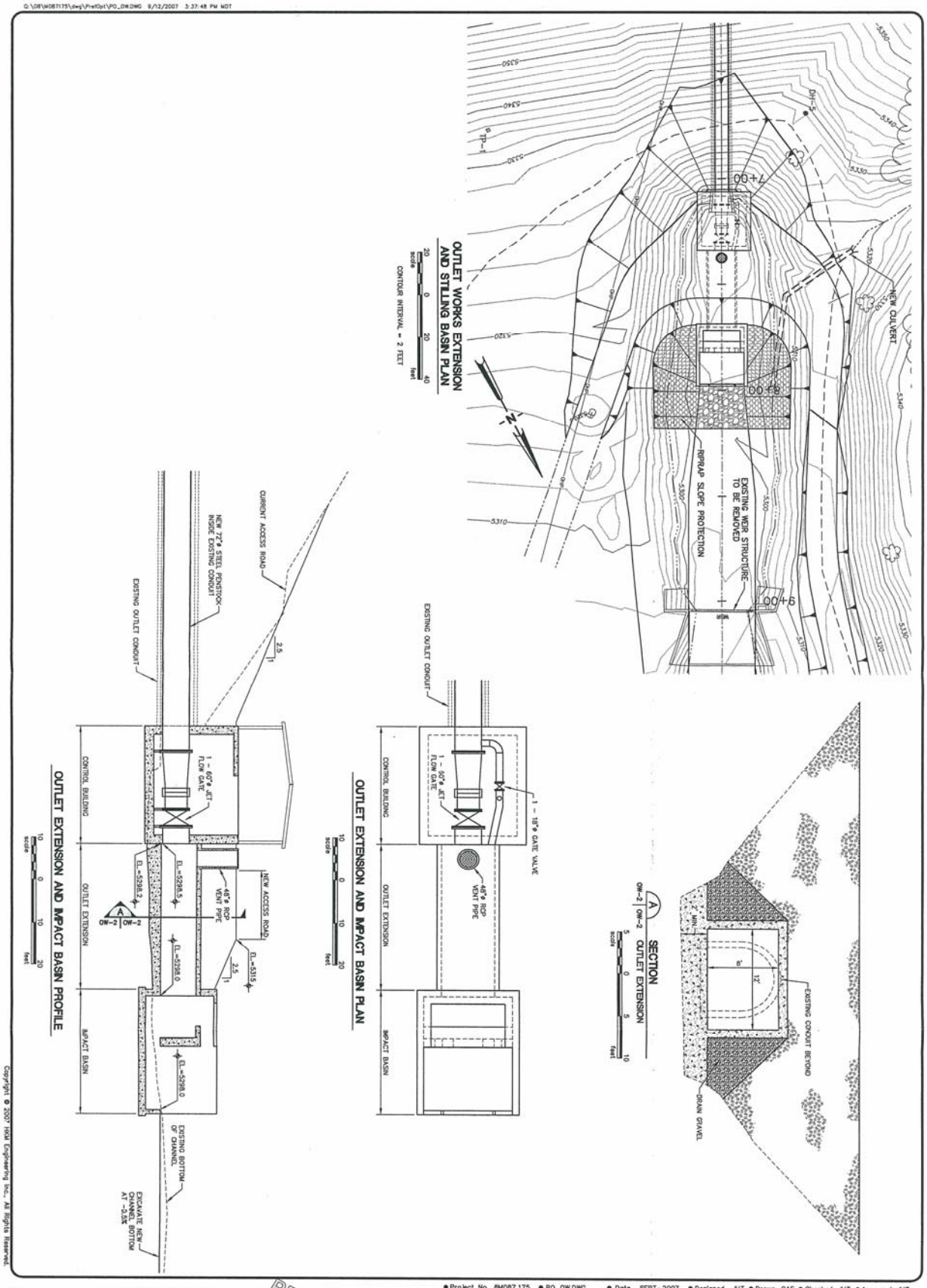

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

OUTLET WORKS EXTENSION & CONTROL BUILDING
PREFERED OPTION

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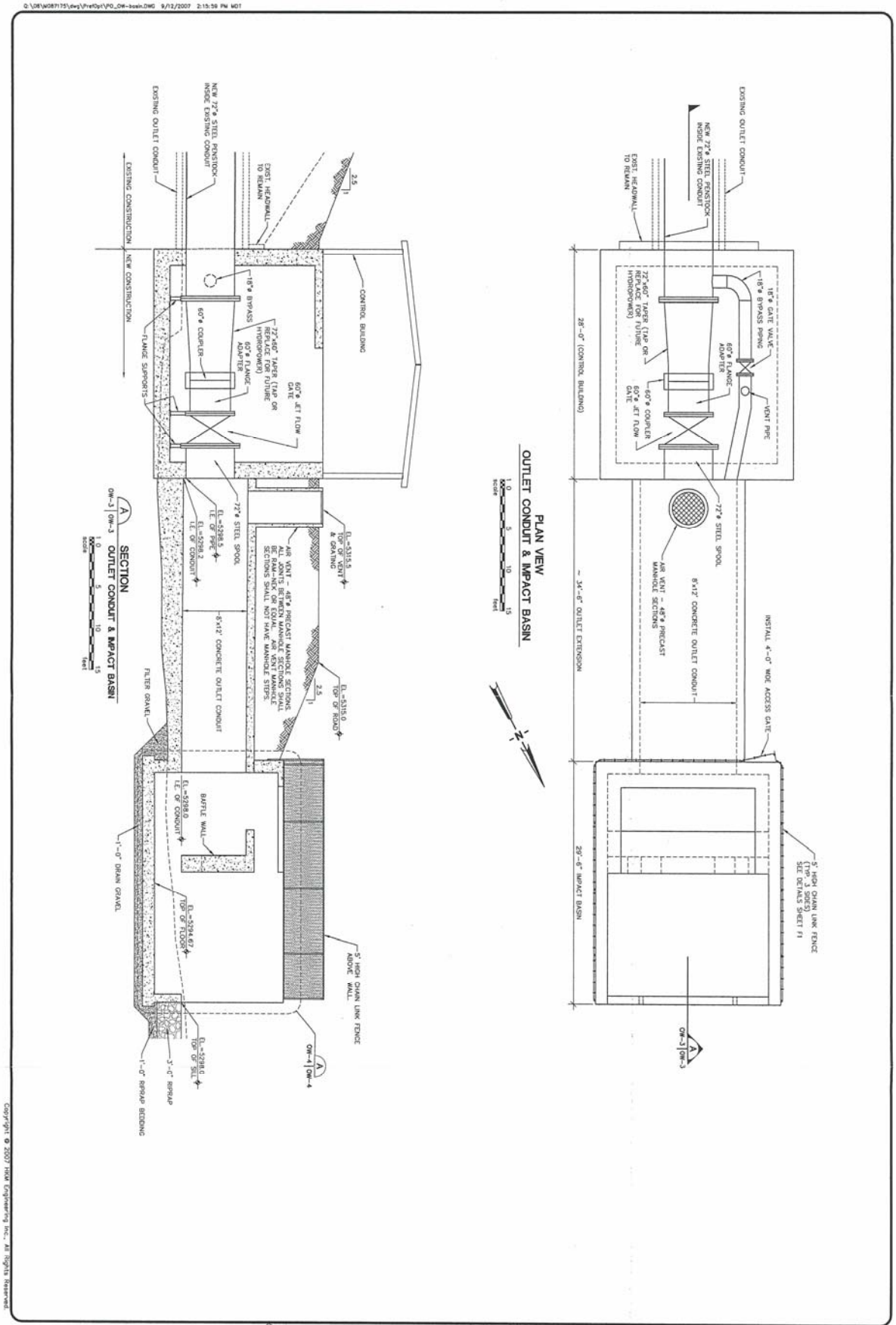

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

OUTLET CONTROL BUILDING, CONDUIT & IMPACT BASIN
PREFERRED OPTION

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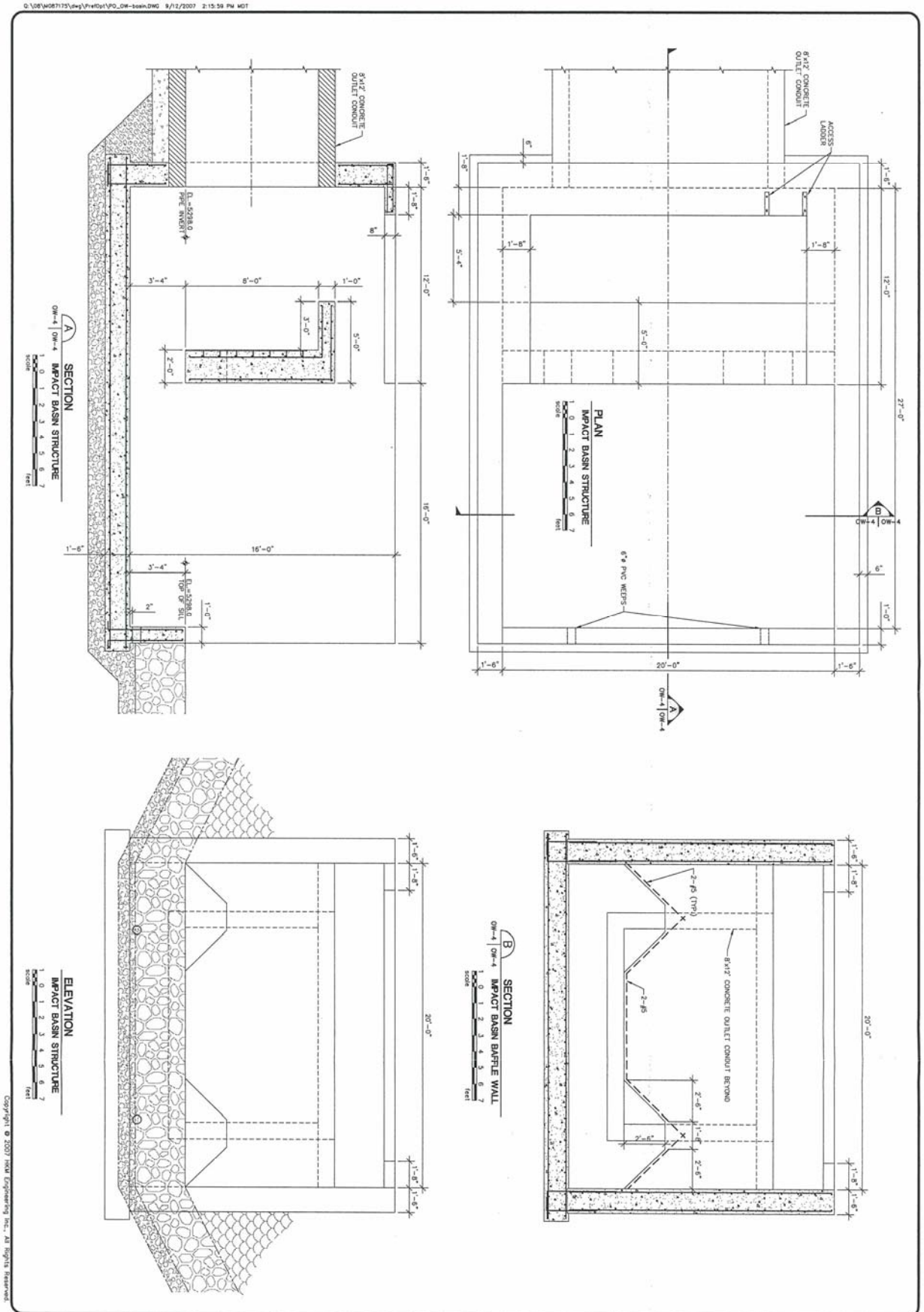

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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA

OUTLET WORKS IMPACT BASIN
PREFERRED OPTION

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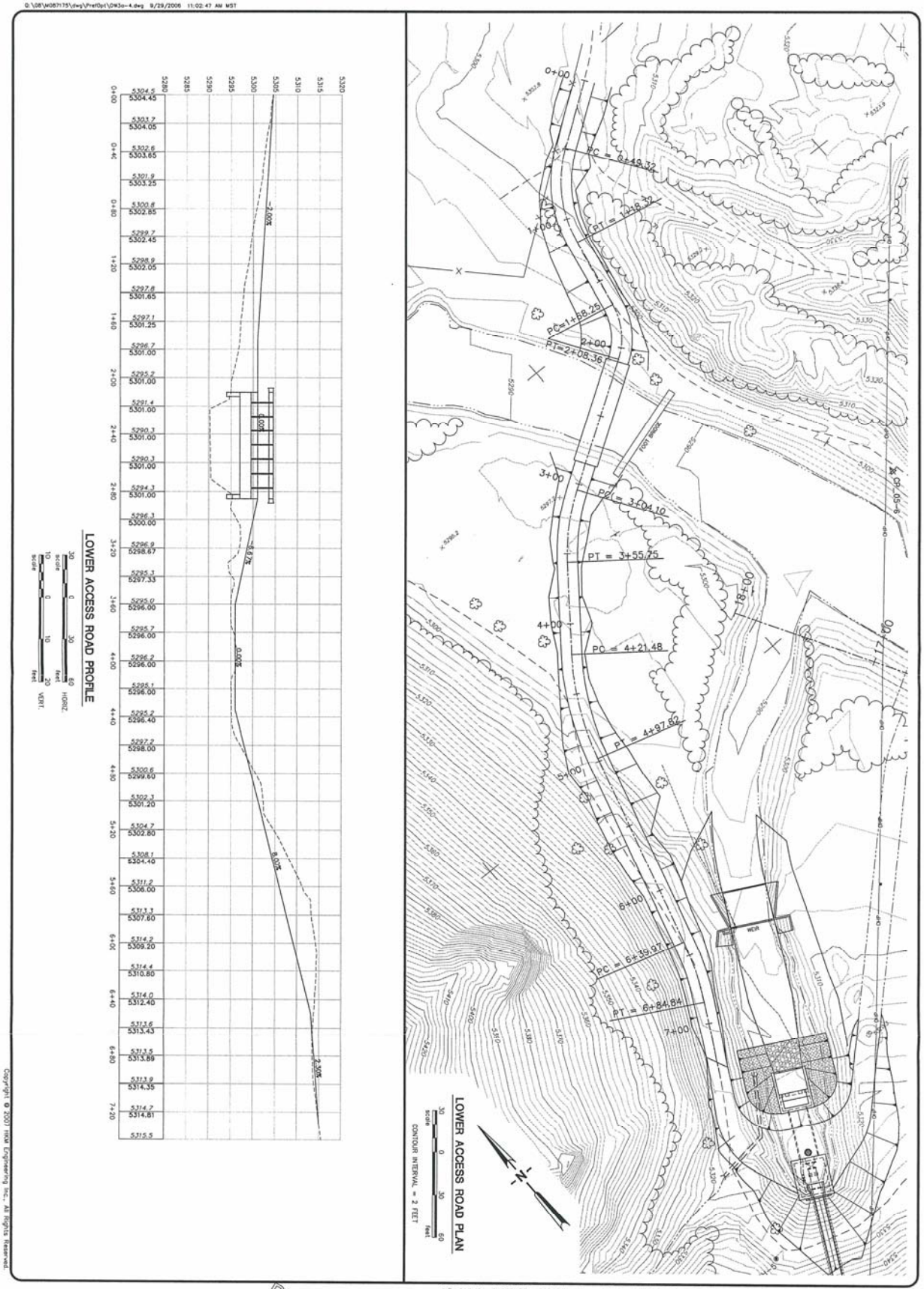
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LOWER ACCESS ROAD PLAN
PC = 0+49.32
PT = 1+18.32
PC=1+88.25
PT=2+08.36
PC = 3+04.10
PT = 3+55.75
PC = 4+21.48
PT = 4+97.62
PC = 6+39.97
PT = 6+84.84
WEIR
CONTOUR INTERVAL = 2 FEET
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RUBY DAM REHABILITATION FEASIBILITY STUDY
MADISON COUNTY, MONTANA
LOWER ACCESS ROAD
PREFERRED OPTION
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RUBY DAM REHABILITATION FEASIBILITY
HKM - 8M087.175
Preferred Rehabilitation Alternative
Cost Estimate

Preferred Alternative - 100' Labyrinth Crest at elev 5400.0 ft; Dam Crest at elev 5413.0 ft; 100' Straight Chute; 100'x50' Combination Stilling Basin-Flip Bucket, new Jet Flow Gate outlet works

Spillway Crest Width =	100	
Spillway Crest Elevation =	5400.0	
Reservoir Storage =	45,115	
Chute Width =	100	
Max Res. W.S. =	5409.9	
Dam Crest Elevation =	5413.0	
Design Capacity =	20,000	
Dam Overtopping Flow =	27,230	
Stilling Basin Length =	50	
Stilling Basin Width =	100	
Stilling Basin Design Flow =	4,000	(500-yr Outflow)

Material Costs			
Floor Concrete	$	800.00	/CY
Wall Concrete	$	1,000.00	/CY
Clay Blanket	$	15.00	/CY
Labyrinth Wall Concrete	$	1,000.00	/CY
Labyrinth Crest Plate	$	105.00	/LF
Rock Anchors	$	575.00	/EA
Excavation	$	12.00	/CY
Rock Fill/Riprap	$	55.00	/CY
Drain/Filter Gravel/Beddi	$	60.00	/CY
Structural Backfill	$	10.00	/CY
Concrete Demo	$	35.00	/CY
6" Drain Pipe	$	15.00	/LF
12" Drain Pipe	$	35.00	/LF
Gabion Fill	$	160.00	/CY
General Fill	$	10.00	/CY
Impervious/Semipervious	$	10.00	/CY

Dam Crest Raise			Unit Cost	Total Material Cost
Riprap Excavation	1742	CY	$ 12.00	$ 20,904.00
Embankment Excavation	5000	CY	$ 12.00	$ 60,000.00
Gabion Fill	840	CY	$ 160.00	$ 134,400.00
Impervious / Semi pervious Fill	8300	CY	$ 10.00	$ 83,000.00
Riprap Fill	809	CY	$ 55.00	$ 44,495.00
Gate House / Extension	1	LS	$ 43,000.00	$ 43,000.00
		Total Cost		**$ 385,799**

Dam Crest Access			Unit Cost	Total Material Cost
Excavation	4448	CY	$ 12.00	$ 53,376.00
General Fill	350	CY	$ 10.00	$ 3,500.00
Pedestrian Bridge	1	LS	$ 79,560.00	$ 79,560.00
		Total Cost		**$ 136,436**

Spillway Approach			Unit Cost	Total Material Cost
Approach Excavation	9600	CY	$ 12.00	$ 115,200.00
Clay Blanket	803	CY	$ 15.00	$ 12,045.00
Access Road Excavation	700	CY	$ 12.00	$ 8,400.00
Access Road Backfill	1900	CY	$ 10.00	$ 19,000.00
		Total Cost		**$ 154,645**

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Preferred Alternative - 100' Labyrinth Crest at elev 5400.0 ft; Dam Crest at elev 5413.0 ft; 100' Straight Chute; 100'x50' Combination Stilling Basin-Flip Bucket, new Jet Flow Gate outlet works

Outlet Works Modifications Option OW4			Unit Cost	Total Material Cost
Demo for Penstock	1	LS	$ 36,750.00	$ 36,750.00
Excavation	350	CY	$ 12.00	$ 4,200.00
Drain/Filter Gravel/Bedding	215	CY	$ 60.00	$ 12,900.00
72" Penstock and Installation	1	LS	$ 282,150.00	$ 282,150.00
18" Bypass Piping	1	LS	$ 3,600.00	$ 3,600.00
60" Jet Flow Gate	1	LS	$ 265,000.00	$ 265,000.00
18" Gate Valve	1	LS	$ 6,000.00	$ 6,000.00
Gate Install (10% Gate Costs)	1	LS	$ 27,100.00	$ 27,100.00
Floor Concrete	152	CY	$ 800.00	$ 121,600.00
Wall Concrete	279	CY	$ 1,000.00	$ 279,000.00
Gate House	672	SF	$ 100.00	$ 67,200.00
Electrical Service	1	LS	$ 10,000.00	$ 10,000.00
Structural Backfill	850	CY	$ 10.00	$ 8,500.00
Riprap	307	CY	$ 55.00	$ 16,885.00
Channel Excavation	680	CY	$ 12.00	$ 8,160.00
Downstream Access Road				
Excavation	797	CY	$ 12.00	$ 9,564.00
Fill	679	CY	$ 10.00	$ 6,790.00
Road Gravel Surfacing	460	CY	$ 60.00	$ 27,600.00
Vehicle Bridge	1	LS	$ 89,270.00	$ 89,270.00
		Total Cost		**$ 1,282,269**

Miscellaneous			Unit Cost	Total Material Cost
Embankment Drain Mods	1	LS	$ 50,000.00	$ 50,000.00
Reservoir Impacts	1	LS	$ 650,000.00	$ 650,000.00
Mobilization/Preparation (15%)	1	LS	$ 1,021,000.00	$ 1,021,000.00
Unlisted Items (10%)	1	LS	$ 718,000.00	$ 718,000.00
		Total Cost		**$ 2,439,000**

Total Direct Construction Costs $ 8,543,560

Program			Unit Cost	Total Material Cost
Geotechnical Investigation	1	LS	$ 20,000.00	$ 20,000.00
Cultural / E. A.	1	LS	$ 15,000.00	$ 15,000.00
Water Rights	1	LS	$ 50,000.00	$ 50,000.00
ROW / Easements	1	LS	$ 1,000,000.00	$ 1,000,000.00
Design (10%)	1	LS	$ 854,000.00	$ 854,000.00
Construction Admin. (7%)	1	LS	$ 598,000.00	$ 598,000.00
Contingencies (10%)	1	LS	$ 854,000.00	$ 854,000.00
		Total Program Costs		**$ 3,391,000**

TOTAL PREFERRED OPTION COST $ 11,934,560

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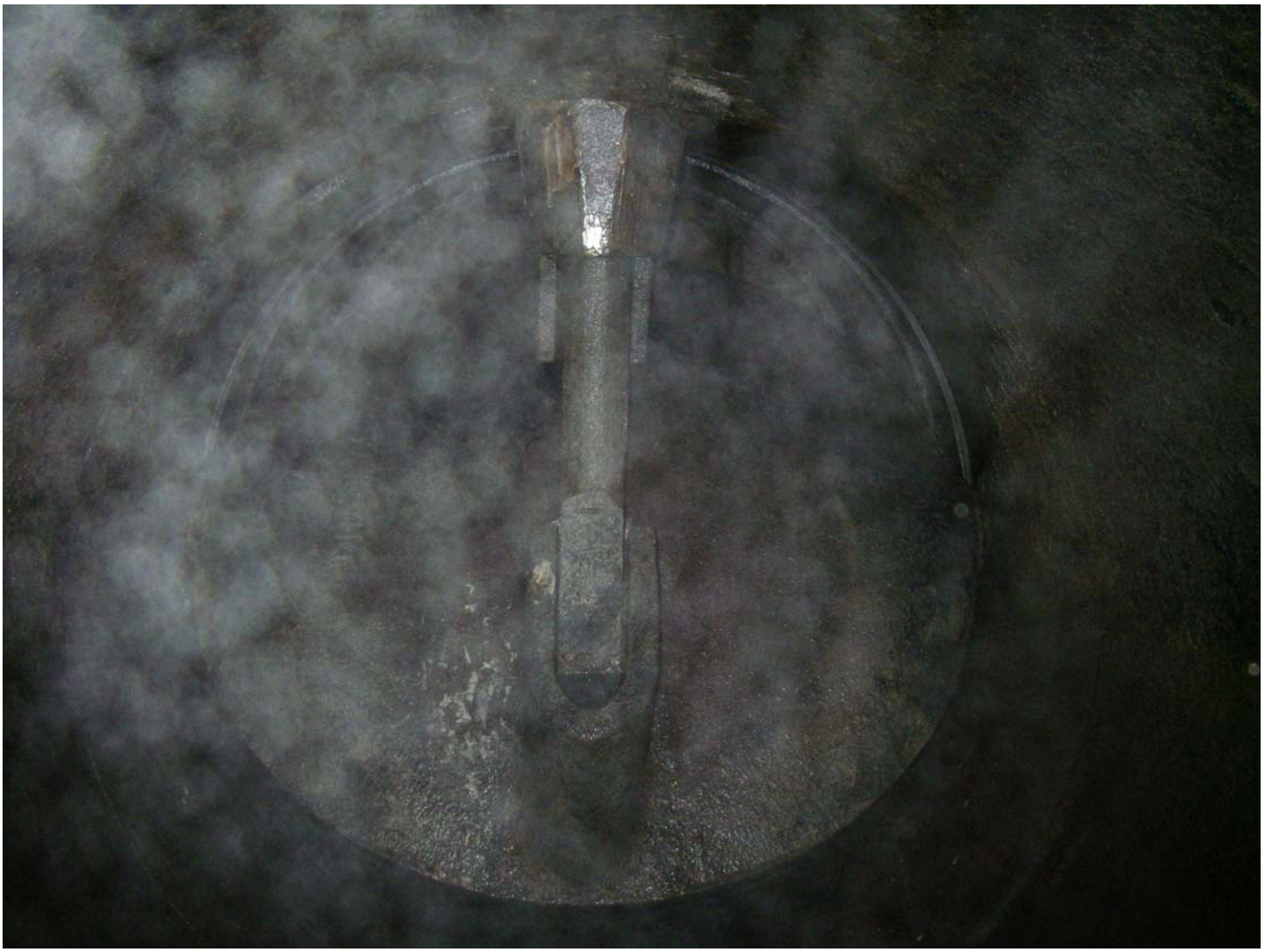
Appendix C: Photographs

Ruby Dam and Spillway – June 2008

Spillway from downstream side

The turbulence in this photo is caused by failed concrete in the floor of the spillway.

Outlet



Main Operating Gate

Cavitation damage inside the outlet tunnel

Downstream side of Ruby Dam